

**TEACHING AND LEARNING ABOUT FOOD - A STUDY OF
CURRICULUM CHANGE IN NUTRITION EDUCATION IN
PRIMARY SCHOOLS**

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CHANGE IN NUTRITION EDUCATION IN PRIMARY SCHOOLS**

ABSTRACT

The development of nutrition education as part of the school curriculum is considered in the first section of this thesis. The second part focuses on an action research project which was part of in-service courses for primary teachers at the Institute of Education. Teaching and learning about food as part of science and health education provided the context for the research.

Each of the seventy teachers involved in the project interviewed three children in their class to explore the ideas which children held about the foods they ate, how they grouped food items, and the types of food choices which they made, as well as the reasons for those choices.

Data from the interviews were used as a means of helping teachers to reflect on teaching and learning and to explore their own ideas about food and health. Reflection on practice was encouraged through discussion and the writing of reports based on the interviews.

The findings from the interviews indicate that children's ideas, particularly about nutrients, are frequently different from accepted scientific views. There is also evidence that children choose foods which they like, rather than those which they consider to be healthy.

Analysis of the reports written by teachers indicates that the interviews have helped to alert teachers to the range of ideas held by children and to increase their own understanding about diet and health. There is evidence that the process of reflection and writing has helped teachers to consider and to develop teaching strategies which are consistent with constructivist learning theory.

The findings from this study have implications for teaching and learning about food in science and health education in primary schools. The information about children's ideas about food and health has importance also for policy and practice at an individual, school and national level.

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ABBREVIATIONS

APU	Assessment of Performance Unit
AT	Attainment Target (National Curriculum)
CCHS	Committee on Child Health Services
CLIS	Children's Learning in Science Project
COMA	Committee on Medical Aspects of Food Policy
CPG	Coronary Prevention Group
DES	Department of Education and Science
DHSS	Department of Health and Social Security
FAO	United Nations Food and Agricultural Organisation
DoH	Department of Health
HEA	Health Education Authority
HEC	Health Education Council
HMI	Her Majesty's Inspectorate
MAFF	Ministry of Agriculture Food and Fisheries
NACNE	National Advisory Committee on Nutrition Education
NCC	National Curriculum Council
PSE	Personal and Social Education
SAT	Standard Assessment Task
SEAC	Schools Examination and Assessment Council
SCHEP	Schools Council Health Education Project
SSCR	Secondary Science Curriculum Review
TGAT	Task Group on Assessment and Testing
Unesco	United Nations Educational, Scientific and Cultural Organisation
WHO	World Health Organisation

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INTRODUCTION

"Children are people. They grow into tomorrow only as they live today." John Dewey

The origins of the study of teaching and learning about food described in this thesis are to be found in the author's work with teachers and children over a period of years, particularly that which has sought to explore ways in which teaching about food and diet can be developed and promoted. The study can be related also to concerns which the author shares with many others about the causes of poverty and ill-health and the effects of these factors on children including malnutrition.

Since 1983 the author has been responsible with colleagues in the Science Education Department of the Institute of Education for developing and running in-service courses in science education for primary teachers. The period from 1983 to 1991 has been a time of rapid and unprecedented change in science education. Science has emerged from a place of relative obscurity and perceived lack of importance to become a compulsory subject area in the primary curriculum. Sudden 'stardom' may be exhilarating but it is rarely achieved without cost. This study provides insights into these changes and the effects which they have had on primary schools, on teachers acting as co-ordinators in science and on the teaching of science

and health education.

In planning the structure and content for in-service courses in science for primary teachers, in particular the Diploma in Primary Science Education and the 35-day courses for Co-ordinators for Primary Science, the author and her colleague, Mrs Jenny Frost, considered it important that teachers should be provided with opportunities:

- to develop their own understanding of science,
- to gain insights into the ideas which children had about scientific concepts,
- for reflection on practice.

The courses aimed to give teachers opportunities to share ideas, to undertake investigative work in schools and to report and analyse this work. The courses also provided opportunities for the development of collaborative research with staff in the Science Education Department; the study reported here is an outcome of one such research initiative.

The research described in the following chapters started in 1987 with a small scale study of children's understanding of ideas about food and nutrition which was undertaken by the author. In the following year the study was extended to become part of a participatory research programme for primary teachers taking the Diploma and 35-day Co-ordinators courses in the Science Education Department. The research programme had three specific purposes:

1. To find out more about the ideas which children hold about food;

2. To investigate how the professional development of teachers could be furthered by:
 - i. developing their awareness of the understandings which children have about ideas related to food and health,
 - ii. increasing teachers own knowledge and understanding in one area of science and health,
 - iii. providing teachers with opportunities to reflect on practice;
3. To investigate how the findings from collaborative research could be used to develop new teaching strategies and/or to extend existing strategies used by teachers.

The work with teachers focussed on three questions:

1. What are the ideas which children have about food, on what basis do they make food choices?
2. What strategies can teachers use to find out more about children's ideas about food?
3. How can the findings concerning children's ideas be used to further both the professional development of teachers and curriculum development?

The author considered that by sharing experiences and working as a team, rather than as individuals, teachers could be helped to recognise the importance of their individual investigative work with children. It was possible that patterns in the results could have profound effects on the ways in which teachers taught topics

subsequently and on how they assessed pupils. The sharing of ideas and results with colleagues in schools could lead to curriculum change and development which was not limited to the classrooms of course participants.

Before embarking on more detailed discussion of the research study and ideas about teaching and learning in relation to food it is important to clarify what is meant by the term nutrition education. Unesco has defined nutrition education as being:

"concerned with teaching and learning about knowledge, attitudes and practices related to food and the way it is used by the human body for energy, growth and development." (Unesco, 1983)

This definition is one which the author finds acceptable in general terms although it implies a view of nutrition education which does not give sufficient emphasis to other equally important aspects of nutrition, including those concerned with the political and socio-economic dimensions of the subject. The Unesco statement does emphasize, however, that nutrition education is not limited to knowledge and understanding but includes consideration of attitudes and practices.

Hollingsworth (1983b) suggests that the aim of nutrition education should be to ensure that:

"all people shall know sufficient about the composition of foods and human physiological needs to be able to make sound choices about the foods they eat." (Hollingsworth, 1983b p.283)

Gussow (1983) puts this more simply when she says that

"nutrition education is, in the broadest sense, a way of teaching us which foods are good to eat." (p.15) This holistic view is a useful starting point for consideration of nutrition education in primary schools provided that it is extended to consider the relationships between diet and health.

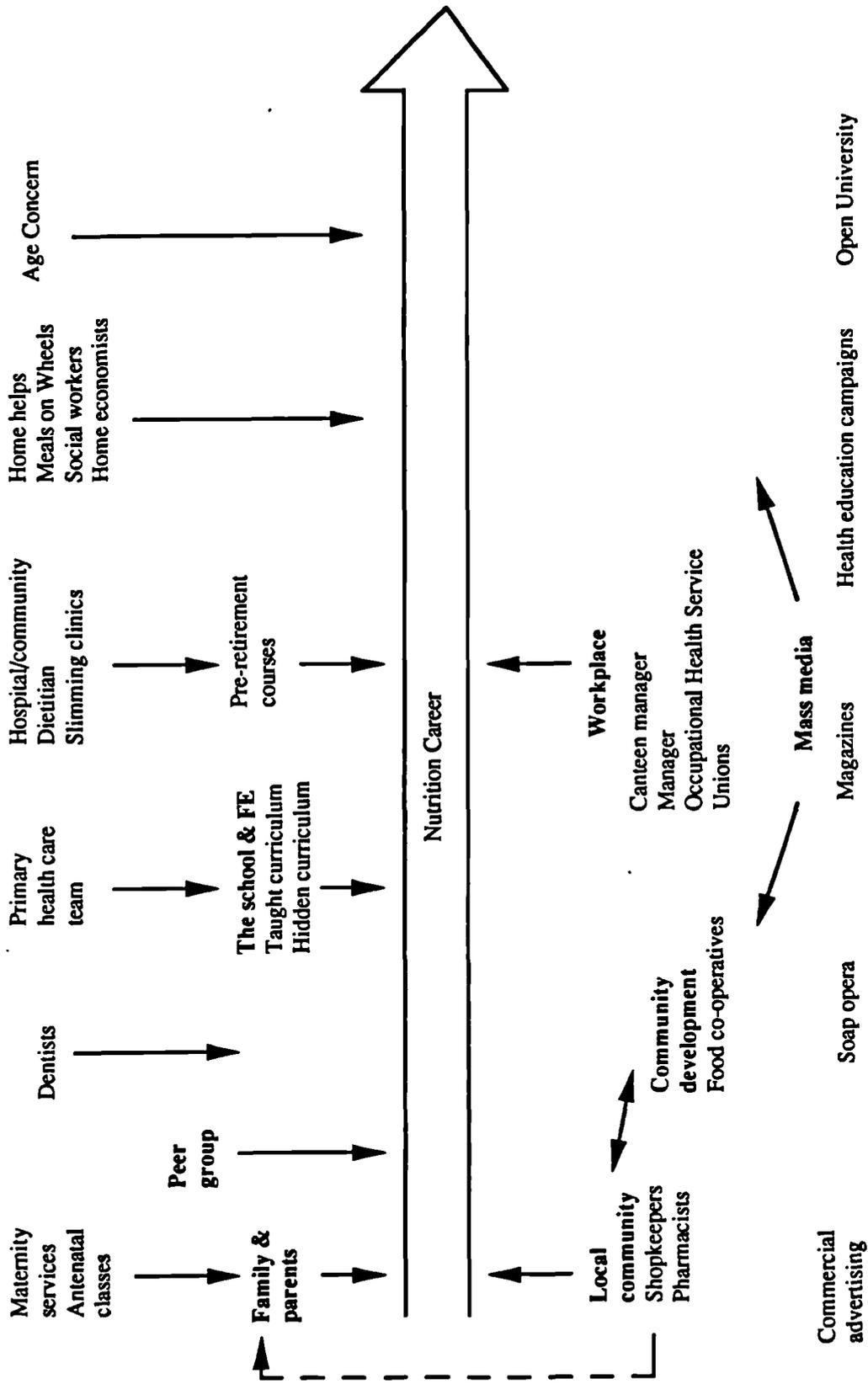
The subject of food choice raised by Hollingsworth is one which has an accepted place in current views of nutrition education as is evident from recent reports about health education (DES, 1986; NCC, 1990b) and teaching materials for use in health education (for example HEC, 1983; Williams et al, 1989a). Teaching about food includes consideration of the factors which govern food choice, including the physiological, sociological, economic and psychological factors illustrated in Figure 2. Recent guidelines produced by the National Curriculum Council (1990b) for teaching about food and nutrition as part of the National Curriculum in England and Wales suggest that nutrition education encompasses:

"the relationships between diet and health, the nutritional quality of different foods and food safety. It encourages pupils to make healthy choices."

(NCC, 1990b p.5)

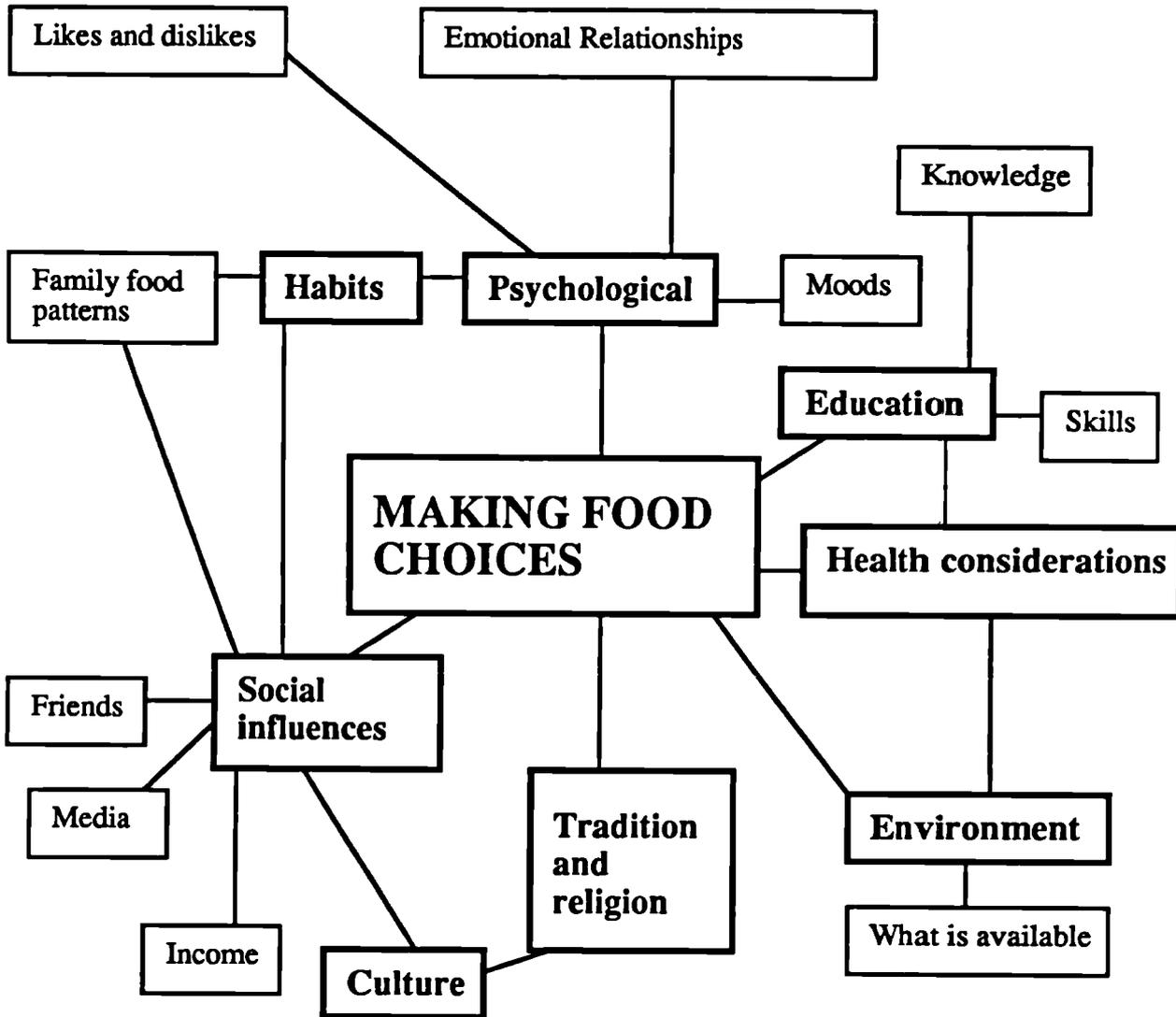
From what has been said above it is apparent that nutrition education is not limited to knowledge about food or its production and distribution but encompasses consideration of ways in which children learn and of their attitudes to diet and health. Furthermore nutrition education in schools is only a small part of what Tones

Figure 1 Educational Influences on a Nutritional Career



Source: Keith Tones (1987) in *Health Education in Schools*, K. David and T. Williams (Eds).

Figure 2. Factors Influencing Food Choices



(1987) identifies as a 'nutrition career', which is illustrated in Figure 1. This model draws attention to the many varied influences on our food choices and eating behaviours. Any study of nutrition education should take account of these influences. The review of the place of nutrition education in the school curriculum which forms the focus of the first chapter considers therefore the socio-economic and political contexts in which schools operate and the influence of social reformers on factors which impinge on nutrition education; for example, the provision of school meals and medical care.

The ideas of psychologists and educators about how children learn and the impact which these ideas have had on teaching are obviously an important element in this study, which considers both children's ideas and approaches to teaching. Chapter I, in discussing education provision since 1870, includes reference to the development of ideas concerning teaching and learning, However, these issues are addressed only in the context of the structure and content of the curriculum. These issues form the focus of the review in Chapter II which looks in particular at children's learning in the areas of science and health education and the implications of research findings for teaching.

When the study described in Part II of this thesis began there had been very little research on children's ideas about food. Furthermore the courses for teachers in primary science education to which the research is linked were relatively new. Courses for Co-ordinators in primary

science had only begun in 1984 (DES, 1984) and, as the author and her colleague Jenny Frost point out (Frost and Turner, 1987), there was no tradition of co-ordination upon which to build. Review of the literature revealed no previous participatory research studies of the type planned in relation to food and nutrition. The questions posed earlier were therefore ones to which solutions had not been sought, they also appeared amenable to solution. Furthermore discussion with primary teachers prior to the start of the study indicated that the purposes identified earlier were seen as both relevant and useful.

The research programme, which is discussed in detail in Chapter III and summarised in Figure 28, centred on interviews with children by teachers on the Diploma and Coordinators courses. The teachers on the courses came mainly from schools in inner and outer London boroughs, a few came from counties such as Essex and Hertfordshire; the schools provided a representative sample of schools in the London area. Between 1988 and 1991 seventy of the teachers participating in the two courses were involved in the research study.

Each teacher was asked to interview three children, representative of their class in terms of background and ability, and to tape record the interviews if possible. Following discussions with colleagues and the author each teacher wrote a report based on the interviews and their findings; where appropriate the reports included edited transcripts of the discussion with pupils. These reports, allied to record sheets completed during the interviews

plus the tape recordings, provided data about children's ideas about food and diet which are discussed and analysed in Chapter IV.

As the interviews were to be carried out by teachers in very different schools and with pupils of different ages it was necessary to develop a structured framework for the interviews which would:

- * provide a framework which would enable results to be analysed but which would not hinder more extended discussion with children,
- * be amenable for use by teachers with varied interests and experience,
- * take account of the constraints under which teachers operate; these include time factors and the availability of quiet areas in which to work with individual children,
- * provide appropriate activities for use with pupils from five to twelve years,
- * recognise the varying abilities and needs of children from culturally diverse backgrounds.

It was not intended that the interviews should be used for assessing pupils.

The discussions with pupils centred around three activities, two of which used outline pictures of food mounted on card as stimulus materials. The pictures of foods used were familiar items chosen to reflect the rich cultural diversity of the schools involved in the study. In the first activity children were asked to group the pictures of food as they wanted. The children were then

asked to use the cards as a basis for selecting foods for meals. In the third activity cards with the names of nutrients, for example salt and sugar, were used to probe children's understanding of common nutrient terms.

The data from the interviews, which is discussed and analysed in Chapter IV, provided considerable and detailed information about the way in which children group foods and make choices about what they eat. The findings were frequently at variance with the results which teachers expected. The food choices which children made were, as expected, influenced by what they ate at home. An equally important factor in determining choice was whether foods were liked; foods were rarely chosen because they were recognised as being 'healthy'. The effect of previous teaching on food grouping and food choice appeared to have little influence on the choices which children made. Children's understanding about nutrients was particularly significant, as were the values which they attributed to particular nutrients. Sugar, salt and fat were recognised by most children; they were also able to explain what these substances were. Sugar and fat in particular were classified as 'bad for you'. Most children of all ages had heard of vitamins, generally in the context of tablets or pills, they were classified as being 'good for you'. Other terms, such as mineral and fibre, were less commonly recognised and few children could describe what such terms meant; many responses revealed confusions and misunderstandings. That some London seven year olds equate 'fibre' with a five pound note is perhaps not surprising!

In addition to providing data about children's ideas about food the reports written by teachers based on the interviews, allied to reports written on teaching science later in the course, provided evidence of what effect the interviews had on their teaching. These findings are discussed and analysed in Chapter V. One purpose of the written reports was to provide teachers with opportunities for reflection on practice, including analysis of their teaching.

The notion of the reflective practitioner, identified by Schon (1983, 1987) is one which has gained widespread recognition in education during the past decade and there is a growing literature on the subject, allied to research which seeks to identify the role and nature of reflection in teaching. Schon used the term to describe the professional who uses reflection as a means of improving practice. The idea of teachers reflecting on practice predates Schon's work, however, by many years. Reflection on practice is implicit even in official government reports which have considered teacher education and teaching practice, including the James Report (DES, 1972). The James Report also made links between such reflection and research.

Schon (1987) identifies the importance of what he terms 'reflection-in-action' (p.26) which he suggests has a critical function in restructuring the knowledge, or constructions, which are used by practitioners. Such reflection can lead to experimentation and further thinking about practice, which in turn the author suggests, can lead

to professional development.

The idea of the teacher as a professional who utilizes reflection as a way of thinking about educational matters and to make informed decisions is also promoted by Ross (1987). Korthagen and Wubbels (1991) argue that although statements about reflection-in-action can be related to good teaching there is a need for more specific analysis of the relationship between the two and they suggest that this is an area which warrants further research.

Chapter V identifies further outcomes of the research for the teachers who participated in the study, including the way in which they planned and taught food focussed topics later in the course. The perceived implications of the outcomes of the interviews for monitoring the progress of pupils, allied to issues of assessment in science as part of the national curriculum, are also discussed.

The majority of teachers with whom the author worked had responsibility for science in their schools; many were promoted to more senior positions on completing the course at the Institute of Education. The influence of these teachers in promoting curriculum change and developing teaching strategies therefore extended beyond their classrooms. The role of co-ordinators as agents of change is a further outcome which is considered in Chapter V.

In the concluding section of Chapter V the author considers the implications of the findings for policy in respect of nutrition education at both school and national level. She makes suggestions about how the outcomes could be used to inform and to develop policy in nutrition education.

PART I

DEVELOPMENTS IN NUTRITION EDUCATION IN BRITISH SCHOOLS

1870 - 1990

CHAPTER I

Nutrition as a school subject; the changing social context

1.1 Introduction

Beatrice and Sidney Webb, in 'Methods of Social Study' (1932), suggest that any study of the organisation of education should include consideration of the views of educators and of the following elements:

- " i. the social machinery of schools and colleges,
- ii. the discoveries of the psychologists as to the child's mind."

(Webb and Webb, 1932, p.12)

In considering the methodology for investigation of education, they advise starting with:

"an exhaustive examination of the structure and function of the social institution itself, and then tracing in it the effects of all factors whatsoever, mental, physical, and social..."

(Webb and Webb, 1932, p.13)

The author considers that the method of study advocated by the Webbs provides both a sound basis for developing the framework for the study of nutrition education described in this thesis and a logical starting point for considering the place and function of nutrition education in the school curriculum.

This initial chapter considers the structure of schools and the curriculum during the period from 1870 to

1990, a period which begins and ends with major government legislation in education. The contexts in which schools operate are important factors in determining the nature and content of the curriculum and therefore the social and political structures, as well as the status of the science of nutrition, will be considered in reviewing changes which have taken place in schools during this period.

The Education Act of 1870 heralded the introduction of elementary school education for the majority of children; it is therefore an appropriate starting point for a study of nutrition education in schools in England. The Education Reform Act of 1988 has resulted in the introduction of a National Curriculum in England and Wales for all pupils from 5 to 16 years (DES, 1989d) in which science and technology, both subjects which include aspects of nutrition, form foundation elements and health education is identified as a cross curricular theme (NCC,1990a).

The period between 1870 and 1990 is one which has witnessed major economic and social change, most notably the emergence of the 'Welfare State' (Social Insurance and Allied Services Report, 1942). There have been major and rapid advances in science and technology. In 1870 nutrition as a science was in its infancy, the emergence of nutrition as a scientific discipline had its beginnings in the work of scientists such as Carl Voit in the mid nineteenth century. The author will argue that the school curriculum cannot be isolated from social and scientific advance and that the development of nutrition education in schools needs to be considered in the context of these

changes and of associated government policy and social reform, for example school meals provision.

In reviewing the history of nutrition education as part of the curriculum three major areas will be considered, namely:

- a. education provision,
- b. public health and social policy,
- c. nutrition and health.

Important 'milestones' which will be examined in relation to these three areas are identified in Figure 3. The author considers that the three aspects, particularly education and social policy, cannot be regarded as discrete entities. Education and education provision are influenced by, and are responsive to, social change and government policy. However, although the three are interrelated, it may not always be easy to make direct links between them. Study of the history of education indicates that change in education is normally a slow process. It may take a long time before ideas from, for example, scientific research, are reflected in school syllabuses or textbooks, or indeed education policy. Furthermore nutritional science has been recognised as a separate discipline in the scientific community for a relatively short time and it can be argued that as a result it has had less impact on the curriculum than older, high status subjects such as physics.

Figure 3 Nutrition, education and social policy - making the links

	<u>NUTRITION</u>	<u>EDUCATION</u>	<u>SOCIAL POLICY</u>
-1870	Voit - 'father' modern knowledge metabolism and nutrition - Calorific value fat, protein, carbohydrate	Education Bill - universal elementary education	Factory Acts
-1871			Local Government Boards set up (combination public health and poor law)
-1872		Devonshire Committee - teaching of science at all levels	
-1875		Elementary code - cookery and domestic economy	Cross Act (slum clearance) - Public Health Act (Simon)
-1880		Compulsory Attendance at school	
-1882		Elementary code - science in Standards I - III: domestic economy introduced	
-1885			
-1890			
-1891		Elementary education made free	Booth Report (London)
-1895			
-1897	Beri-beri described Eijkman (thiamin B1)		

	<u>NUTRITION</u>	<u>EDUCATION</u>	<u>SOCIAL POLICY</u>
-1900			
-1901			Rowntree Report - Poverty in York
-1902		Education Act (Balfour) Formation of LEAs	
-1904			Taylor Inquiry - health of army reservists; Prevention of Cruelty to Children Act
-1905			
-1906		Education Act - Provision of school meals (school meals extended)	
-1907		Education Act Administrative Provision: medical inspection and treatment	
-1909			
-1910			
-1911			National Insurance Act (Lloyd George)
-1912	Scurvy in guinea pigs (Holt and Frolich)		
-1913	Vitamin A identified (McCollum & Davis; Osbourne & Mendel)		
-1915			
-1918	Role of Vitamin D in prevention / cure of rickets demonstrated (Mellanby)	Education Act (Fisher) - nursery schools; school leaving age raised to 14 years	Food rationing introduced
-1919			Ministry of Health formed
-1920	Vitamin E identified (Evans and Bishop)		Dawson Report - Outline of National Health Service
-1921			Food rationing ends
-1925			
-1926	Vitamin B isolated	Education of adolescents (Hadow Report)	
-1928	Vitamin C isolated (Szent-Gyorgi) - not recognised as a vitamin		

	<u>NUTRITION</u>	<u>EDUCATION</u>	<u>SOCIAL POLICY</u>
-1930			Ministry of Health Committee of Nutrition set up
-1931		The Primary School (Hadow Report)	
-1932	Vitamin C identified		
-1933	Vitamin A chemistry (Karrer <i>et al</i>); Vitamin C synthesised; Riboflavin isolation (Kuhn <i>et al</i>)	Infant and Nursery Schools Report	BMA Report on Nutrition
-1934			School Milk Act
-1935			
-1936	Vitamin B1 synthesised; Vitamin E isolated (Evans & Emerson)	Education Act	Food Health and Income Report (Boyd Orr)
-1937	Nicotonic acid isolated (Elvenjem <i>et al</i>)		
-1938	Vitamin E chemistry (Karrer <i>et al</i>); importance of folic acid demonstrated (Day; Hoggan & Parrot; Snell & Petersen)	Spens Report	
-1940	Vitamin K isolated (McKee <i>et al</i>)		Food rationing introduced
-1941			School meals provision (1000 cal); school meals part of war economy
-1942			Beveridge Report
-1944		Education Act (Butler); school meal confirmed as part of educational day	Ministry of Health Report on Public Health (including Nutrition); Family Allowances introduced
-1945			
-1946			National Health Service Act, National Insurance
-1948	Vitamin B12 isolated		
-1950			Food rationing ends
-1955			

<u>NUTRITION</u>	<u>EDUCATION</u>	<u>SOCIAL POLICY</u>
-1960		
-1963	Robbins Report (^{Higher} Health Education); Newsome Report (Half of our future)	
-1965	CSE introduced	
-1966		Revision in nutritional standard of school dinners
-1967	Plowden Report; Function of HMIs specialising in school meals ceased	Nutritional guidelines for school meals revoked
-1968		School milk secondary schools ceases
-1970		
-1971		Free school milk abolished for children over 7 years
-1974		UN World food conference
-1975		
-1976		Court Report - Child Health Service
-1978	HMI Report on primary education	
-1980	Education Act - school meals provision	
-1983		NACNE
-1984		COMA Report
-1985	Better Schools (DES); Science 5-16: a statement of policy	
-1988	Education Reform Act; National Curriculum	
-1989		Report on diets of British School children
-1990		WHO Report on diet
-1991		DoH Report on the Health of the Nation

1.2 Educational Provision

During the period 1870 to 1990 nutrition has rarely featured as a separate subject in the curriculum for children from five to eleven years. However, teaching about food and diet has taken place as part of science and what are generally termed 'domestic' subjects, such as cookery or domestic economy or home science. In considering the development of nutrition education it is therefore important to explore the development of science and 'domestic' subjects as part of the curriculum and to look at what are generally termed cross curricular areas such as hygiene or health education. The differing educational provision for girls and boys, particularly in the context of 'domestic' subjects which were rarely part of the curriculum for boys, is a further element in any consideration of the place and status of teaching about nutrition.

Legislation and the reports of government committees are a useful starting point for consideration of curriculum change. Gordon and Lawton (1978) suggest that such legislation and reports provide indicators of curriculum change rather than reasons for change. In their view the connection between politics and the curriculum has always been a strong one. The provision of elementary education for the poor during the nineteenth century was seen as a mechanism by which social order might be maintained rather than an educational ideal. Similarly the limitation of the elementary school curriculum reflected nineteenth century

views of social class. In reviewing educational change from 1870 to 1990 links also need to be made between education and aspects of social policy, which are summarised in Figure 3 and which are discussed in Section 1.3.

1.2.1 Education for all - Milestones in Education 1870 to 1901

The stated intention of the Education Act of 1870 was to provide efficient elementary schools throughout England and Wales for children from five to eleven years. School Boards, elected by the local borough or parish, could build their own schools. These new schools would supplement, but not replace, already existing schools such as the Voluntary schools run by churches; a dual form of provision which has continued to the present day.

The curriculum for the board schools was based upon that recommended by the Revised Code of 1862 which specified the content of the curriculum in which emphasis was placed on the teaching of the 'three Rs' - reading, writing and arithmetic. The 1862 Code had also introduced, as Gordon and Lawton (1978) point out, the system of 'payment by results' in which grants to elementary schools were based mainly on annual examination results in the three Rs. The system of payment by results was to remain in force until the end of the century and, the author contends, served to limit curriculum development and innovation.

Reports on education from 1871 to 1882 in the form of Education Codes (1871; 1875; 1882) indicate the growing awareness of the need for the teaching of science, including practical work, to be part of the elementary school curriculum. By 1899, the last year in which grants were paid to schools based on subjects, elementary science was one of the approved class subjects. Science included the study of specific topics which formed part of the scheme of work for science outlined by the Elementary Code of 1898, for example the study of foods, such as bread and milk. Although the Committee of Council of Education (1898-1899) recommended that science teaching should be "mainly by experiment and illustration", rather than by "definition and verbal description", Jenkins (1979) suggests that this ideal was not always achieved.

In the period after 1870 some school boards instituted experimental schemes in cookery, mainly for girls. Gordon and Lawton (1978) suggest that these cookery schemes were not widely adopted for two reasons. The first reason was a pragmatic one, the schemes were not recognised initially by the Education Department and therefore received no extra grant. The second reason was related to the low status of the subject which, as Attar (1990) points out, was a problem which continued until the introduction of Technology as part of the National Curriculum (DES, 1990). Following the recognition of the subject in 1874 it broadened to include aspects of health and hygiene as well as home making and cooking.

By 1887 the terms 'Domestic Science' - the science of

domestic economy and hygiene - and Domestic Economy were being used, and these two subjects were recognised by the Education Code of 1887. The importance of practical work was stressed, indeed it was stated that:

"It is intended that instruction in this subject should be entirely experimental, the experiments, as far as possible, being carried out by the schools themselves and arranged with the object of solving a definite problem."

(Education Code, 1887 - Annual Report of Ministry of Education quoted in Gordon and Lawton, 1978 p.112).

Insights into the position of science and nutrition education in the school curriculum at the end of the nineteenth century can be obtained also from contemporary reports, for example Rowntree's study of poverty in York (Rowntree, 1901) which includes information about elementary school provision in the city. Pupils attending Board schools in York studied elementary science as one of the 'optional' subjects in Standards I to III; girls were also able to study domestic economy, the implication being that boys would not study the subject. In the upper classes girls were able to study cookery in addition to elementary science and domestic economy. Although details of what was taught are not recorded by Rowntree it appears that elementary science covered the 'Laws of Health'. Domestic economy included a study of "food stuffs" (Rowntree, 1901). The basis of the teaching about food stuffs in domestic economy can be surmised from Rowntree's dietaries, such as that for children of 8-16 years shown in Figure 13, which

were based on understanding of diet and health at that time and which were calculated to provide sufficient quantities of food.

Reports such as Rowntree's drew attention to what was happening in schools as part of consideration of issues of concern amongst social reformers, such as poverty, which are discussed in Section 1.3. These reports influenced the social structures of schools, for example in providing school meals, rather than the curriculum. The main factors which influenced curriculum change during the nineteenth and early twentieth centuries are those identified by Gordon and Lawton (1978), which include:

- specialist commissions appointed by reforming governments,
- views of leading politicians,
- innovative headteachers,
- criticism of the existing curricula by contemporary writers.

The final year of the nineteenth century saw the formation of the Board of Education (Board of Education Act, 1899). Gordon and Lawton (1978) signify that a very important feature of this Act was the provision for the formation of a Consultative Committee which would advise the Board of Education on specific issues. This view is supported by the influence of reports by the Consultative Committee during the first half of the twentieth century, for example the Hadow Reports (Board of Education, 1926: 1931; 1933) which are discussed in Section 1.2.2.

This section began by making reference to 'payment by

results' and it is therefore appropriate that it concludes with reference to the Elementary Code of 1900 which ended this system of grants based on subjects allied to organisation and discipline. From 1900 a new block grant was introduced for all elementary schools which was based on the numbers of children on role. An important outcome was that examinations ceased to dominate the elementary curriculum. The new Elementary Code also provided, as Gordon and Lawton (1978) indicate, the first comprehensive official statement on the subjects which should be taught 'as a rule'. The Code did not specify syllabuses. Science was included in both the Code of 1900 and 1902, as Jenkins (1979) comments, only by reference to:

"lessons, including object lessons, on ... common things" (Elementary Code, 1900 in Jenkins, 1979)

Science did appear, however, in a second group of subjects which could be taught if deemed practicable and desirable by the inspectorate, as did cookery for girls.

1.2.2 Education in peace and war - 1902 to 1944

The main provisions of the Education Acts from 1902 to 1944 with reference to children from five to eleven years are summarised in Figure 4. From Figure 4 it can be seen that legislation during this period related principally to school provision and organisation and not to matters of curriculum. A number of the Acts included provision for the welfare of children, for example the Acts of 1906 and 1907, which will be considered later in Section 1.3.

Figure 4

Education Acts 1870 to 1990 - summary of provision with particular reference to children from 5 to 11 years

Date	Summary of Provision
1870 Elementary Education Act (Forster)	Universal primary education; School Boards formed
1880 Education Act	Compulsory attendance at school
1899 Board of Education Act	Board of Education established in 1900; elementary school subjects listed; science might be taught.
1902 Education Act (Balfour)	Formation of Local Education Authorities LEAs permitted to establish secondary schools
1906 Education Act	Provision of school meals
1907 Education	Administrative provision: LEAs to provide medical inspections and given power to make arrangements for medical treatment
1918 Education Act (Fisher)	National system of public education. Extension of medical inspection and treatment LEAs to attend to "health, nourishment and physical welfare of children". School leaving age raised to 12 years
1936 Education Act	Changes in religious education in "non-provided" schools School leaving age raised to 15 years
1944 Education Act (Butler)	School meals confirmed as part of school day Education to be organised in three stages; primary to be first stage. Religious education specified.
1980 Education Act	National nutritional standards for school meals abolished; LEAs given discretionary powers to provide milk and meals at a suitable charge.
1988 Education Act	National Curriculum 5 to 16 introduced. Curriculum subjects and assessment specified

The curriculum for elementary schools at the beginning of the century was viewed in broad terms which were outlined in the Codes for use in Public Elementary Schools (1904-1924) (Board of Education, 1942) the aims of which were formulated by Sir Robert Morant, Head of the Board of Education in 1904. The purpose of elementary schools was considered to be to prepare children, practically and intellectually, for "the work of life".

The content of what should be taught in elementary schools, other than in religious education, was not specified after 1926. Taylor (1975) suggests that this lack of control over the curriculum was "a stroke of unplanned good fortune" for educators. Gordon and Lawton (1978) argue, however, that the removal of government control over the elementary curriculum could have been planned for political reasons and that the freedom which teachers had to plan the curriculum was more apparent than real.

The Hadow Report of 1926 (Board of Education, 1926) was the first of three very influential reports by the Consultative Committee of the Board of Education which were to change the way in which elementary schools were organized. The Report advised that children over the age of eleven years should be educated in separate senior schools, with primary schools catering for children up to the age of eleven years. Although the Hadow Report viewed education from five to fifteen years as being part of a continuum it suggested that each stage, namely infant, junior and secondary, had special features which were best catered for

in separate schools. One of the great achievements of this Report, Taylor (1975) suggests, was that it provided recognition that all children, not just the privileged, were entitled to secondary education.

The second Hadow Report on primary schools (Board of Education, 1931) supported the earlier Report's (Board of Education, 1926) recommendation that primary education should end at age eleven. This report, and the 1933 Report on infant and nursery schools (Board of Education, 1933), also signified, according to Gordon and Lawton (1978) an important landmark in primary education. The model of primary education advocated was one which was more progressive and better suited to meet the needs of all children.

Although many of the recommendations made by the Hadow Committee were not implemented until after 1944 the Board of Education 'Handbook of suggestions for teachers' (Board of Education, 1937), indicates that by 1937 Infant (5 to 7 years) and Junior Schools (8 to 11 years) were becoming increasingly common. The Board of Education (1937) advocated that each class in primary schools should be taught by one teacher, a "general practitioner" (Board of Education, 1937) having responsibility for teaching all areas of the curriculum, although drawing on the expertise of other staff where necessary; this model is one which is still the norm. The Handbook acknowledged that variations in the curriculum would occur depending on the location and size of the school and the qualifications and expertise of the staff.

The Board of Education Handbooks, which were published regularly between 1905 and 1944, reflected prevailing ideas concerning the theory of education. Sellick (1972) comments on the way in which during the period from 1905 to 1927 the Board became increasingly "sympathetic to progressive theory". The 1937 Handbook (Board of Education, 1937) indicates that views of education were changing to a more child centred approach, which took account of the needs and development of the individual child and which placed greater emphasis on social development. The model of the curriculum outlined in the Handbook reflected ideas advocated in the Hadow Report on the Primary School (Board of Education, 1931). The curriculum, particularly for younger children, was conceived in terms of areas of experience and activities rather than subjects or "knowledge to be acquired and facts to be stored" (Board of Education, 1931). The notion of the spiral curriculum, later identified by, for example, Miel (1964), was implicit in the advice given to teachers on the need to return to topics at intervals as the child progressed through school, building on previous experience in order to extend and to deepen understanding.

Although the Board of Education (1937) did not advise the teaching of subjects as such in primary schools it did provide guidance about groups of subjects which should constitute part of the normal curriculum. These broad subject groupings include some which are relevant to nutrition, for example Health Education, Housecraft and Gardening, and Nature Study and Science. Guidance on health

education was given in a specific handbook (Board of Education, 1933) as well as in the general handbook (Board of Education, 1937).

Health was not considered a subject which was taught on its own, it was concerned with "healthy living" (Board of Education, 1937), including hygienic practices, and permeated many areas of the curriculum such as housecraft and natural science. The importance of relating the habits of the individual to the needs of the community was stressed as was relating theory to practice. The notion of training children in health related behaviour by precept and practice was a strong one.

Housecraft, which encompassed cookery, laundrywork and housewifery, was only taught to girls in secondary/senior schools. However, the development of basic social skills in primary schools, for example during school meals, was identified as a good basis for later experience of housecraft. Practical cookery was linked to the development of skills which could be used in the home. Links were also advocated with other subjects such as biology, for example investigating the effect of light on food stuffs. The Board of Education (1937) gave guidance on teaching strategies, which included pupils giving demonstrations as well as teachers, and on content. Work on the choice and price of food stuffs, it was suggested, should be linked to shopping as part of the course. Of particular interest is the advice given by the board on avoiding specialist terminology when teaching about the value of different foods in the diet, something which will be considered later

in Chapters II and III. The terms which were considered appropriate in relation to food values were ones like body-building or bone-making.

School gardens were viewed by the Board of Education (1937) as an amenity for schools as well as being linked to practical experience for both girls and boys. Cultivation of flowers as well as vegetables and fruit was advocated in both rural and town schools. Although the production of food was not the primary purpose food grown by pupils could be sold for use in cookery lessons, or by the school canteen, and thus provide experience of the economics of food production for older pupils. Gardening and science courses were considered to be complementary, as was the keeping of livestock, such as poultry, in senior schools. Skills, such as careful and systematic observation, which were developed in gardening were recognized as being of great importance in science.

The author contends that the view of science promoted by the Board of Education for primary schools in the nineteen thirties (Board of Education, 1937) had many similarities with good practice identified in primary science education some fifty years later (DES, 1983). The model of science outlined by the Board of Education (1937) was one based on practical experience and activity. The role of the infant teacher was to:

"bring children into contact with the right kinds of experience, to encourage them to observe, to experiment, to discover, to talk about their experiences ... " (Board of Education, 1937)

The activities suggested, which included growing plants which could be eaten and study of mechanical appliances, were linked to children's own experience. The activities were related also to other areas of the curriculum, including language development and mathematics.

The Education Act of 1944 (Ministry of Education, 1944) can be seen as the culmination of a process initiated by the Hadow Reports (Board of Education, 1926; 1931; 1933). Shearman (1944) argues that the Act also reflects pressure for change which came from the Council for Educational Advance which was set up in 1942 and whose representatives included members of the National Union of Teachers and the Workers' Education Association.

The main provisions of the Education Act of 1944 are summarized in Figure 4. From this Figure it is apparent that the Act implemented the Hadow recommendations for three successive stages of education, starting with primary from five to eleven years. As Shearman (1944) indicates the Act was regarded as a:

"great advance in the provision of educational opportunity for every child in the land" (Shearman, 1944)

Other than the provisions for religious education the Act made no mention of subjects which should constitute the curriculum. Some of its most important provisions related to the welfare of children including medical inspection, free medical treatment and the provision of milk and meals, which are discussed later in Section 1.3. The Board of

Education was to become a Ministry, thus giving it increased status in government, with Central Advisory Councils for England and Wales replacing the Consultative Committees. The provisions of the Education Act of 1944 were both influential and enduring, they remained largely unchanged for the following forty years.

1.2.3 Primary education in the post war years

All of the features which characterised education in the period following the publication of the Education Act of 1944 have to be set in the context of social change, including the creation of the Welfare State which is discussed in section 1.3. Hoyle (1971) suggests that the relationship between social change and change in education is a complex one. He supports McGee's (1967) argument that distinctions need to be made between schools as agents of change and as places which reflect and respond to changes in society. Hoyle argues that there was a shift from elitist to egalitarian values during the nineteen sixties which was reflected in education; he also points to the "institutionalization of innovation" in schools at this time.

The changes noted by Hoyle created what Bassett (1971) characterised as a "ferment in primary education" of which the Plowden Report (DES, 1967) was an expression. Bassett identified three features of primary education at that time. The first of these features was the emphasis on less formal approaches to teaching, which were linked to

behavioural models of education which focussed on the growth of the individual. The second element was related to notions of relevance in the curriculum in which the child's environment was used as a starting point for learning. The Nuffield Junior Science Project (1967), which is discussed later, provides a good example of this model of education in practice. Finally, Bassett draws attention to the interdependence of curriculum innovation and methods of teaching with the environment of the school as a whole, including its organisation, buildings and location.

Detailed information about English primary schools and the curriculum in the post war period comes from the Report by the Central Advisory Council for Education Committee, chaired by Lady Plowden (DES, 1967). The Plowden report was particularly important as it was the first official review of primary education since the Hadow Reports in the nineteen thirties (Hadow, 1931; 1933). The task of the Committee was to consider all aspects of primary education as well as the transition to secondary schools. The Committee made a number of recommendations which were to have a profound influence on the structure of primary education for the following twenty years, they included:

- the creation of First (5 to 8 years) and Middle Schools (8 to 12 years) with transfer to secondary schools at age 12,
- the definition of Education Priority Areas (EPAs).

The Report stressed the idea of 'positive discrimination' for disadvantaged groups, which Hoyle (1971) suggests was a pragmatic solution to the problems of

deprivation in the areas identified as EPAs, the majority of which were in inner cities. The Report emphasized the need for continuity between the different stages of education and thus reinforced the Hadow Report's (1926) view of education from five years as part of a continuum.

One section of the Plowden Report was devoted to the curriculum and the internal organisation of schools (Part 5). As Gordon and Lawton (1978) point out the report reflects a generally 'progressive' view of primary education, which they suggest was characteristic of Ministry of Education thinking in the period after 1944. The Report advocated a flexible approach to the curriculum, arguing against rigid division of the curriculum into subjects, particularly below the age of nine years. This approach was recognized as one which would:

"make good use of the interest and curiosity of children, ... minimize the notion of subject matter being rigidly compartmental ..." (DES, 1967, p 198)

The Report suggested that such approaches permitted more flexibility and variety in teaching strategies; the idea of the teacher as facilitator, rather than as a purveyor of knowledge was promoted. Central to this teaching approach was the notion of topic based work, with children engaged in a mixture of individual and collaborative group work, which included problem solving activities. Whole class teaching was not precluded in this approach.

In the author's experience the 'progressive' views of education promulgated in the Plowden Report were supported

by many primary teachers although, as Galton points out (Galton et al, 1980), the report contained little guidance on the implementation of the teaching strategies advocated. There was criticism of the Report from 'traditionalists', as is evident from the Black Papers (Cox and Dyson, 1969) which considered egalitarian ideas as a threat to the quality of education. Criticism came also from some educators, including Peters (1968), who argued that Plowden lacked a sound theoretical base, it was premised on concepts and assumptions about education which were as yet unproven.

A further aspect of the Plowden Report is worth commenting on in the light of legislation which formed part of the Education Act of 1988. Plowden suggested that information should be collected about national levels of attainment, especially in mathematics and reading. The suggested mechanism was by means of surveys by the DES and the National Foundation for Education Research.

Evidence concerning the extent to which the ideals of Plowden were realised in primary schools comes from research undertaken in the years following the publication of the Plowden report in 1967, for example that by Bennett and Jordan (1975) and Bennett et al (1976). The styles of teaching observed by Bennett and his colleagues ranged from very formal teaching to the informal progressive methods advocated by Plowden. Bennett's results indicated that formal and mixed methods were associated with greater progress in basic skills generally; concluding that a degree of teacher direction was essential for effective

learning to take place and that learning experiences needed to be clearly sequenced and structured.

Further evidence about practice came from the 'ORACLE' study (Observational Research and Classroom Learning Evaluation) (Galton, Simon and Croll, 1980). This research was based on a longitudinal study with the same teachers and pupils being observed over a period of three years; their study included children moving from primary to secondary schools. The findings indicated that although in the majority of primary classrooms children were seated in groups most of the work was individual. Galton et al found no evidence that cooperative group work of the type advocated by Plowden was being implemented routinely, indeed only ten per cent of the work observed in classrooms was of this type. Over fifty per cent of teachers never used cooperative group work even when teaching topic based work. Learning which involved investigating, problem solving and discovery methods was rare. The ORACLE study demonstrated also that a teacher's interaction with individual pupils was on average only nine minutes in any one hour, a figure which included the time spent by the teacher talking to the whole class. Further, the research indicated that most higher level cognitive exchanges with pupils normally occurred in whole class rather group situations; interactions with groups tended to be managerial. The researchers pointed out that these findings did not necessarily indicate that the methods advocated by Plowden were not valid but that they were impractical with large classes. Furthermore, as they point

out, Plowden did not provide either a consistent rationale for group work nor was clear guidance provided for teachers on how such work might be organized or managed.

The HMI national survey (DES, 1978) of primary schools supported the findings of the ORACLE study that the principles advocated by Plowden were not being implemented in many primary classrooms. The HMI ^{survey} observed that three-quarters of teachers used a mainly didactic approach, whilst one-fifth used a mixture of exploratory and didactic approaches. The HMI survey, in addition to its general findings, provided extensive evidence about the status and extent of science teaching in schools. The findings on science were of particular interest in view of the major curriculum development projects in science in the nineteen sixties and seventies. The Nuffield Junior Science project, which started in 1964 under the auspices of the Nuffield Foundation, and which was later supported by the Schools Council, owed much to the 'progressive' ideas identified in the Plowden report (DES, 1967) and the earlier Hadow Reports (Board of Education, 1931; 1933).

Nuffield Junior Science (1967) was developed by a team working in classrooms and ideas and materials were trialled extensively in schools. The project produced both Teacher's guides, which contained guidance on teaching approaches, classroom organization and resources, as well as source books of ideas. As Bassett (1971) points out the environment was used as a starting point for science which was based on a practically based discovery approach. Links with other subjects were stressed and science was seen as

interdependent with other areas of the curriculum. Very importantly the project looked at science from five to thirteen years, as did its successor 'Science 5-13'. 'Science 5-13' (Ennever and Harlen, 1972) developed and extended the work of the Nuffield Junior Science project; the objectives were clearly formulated and based on ideas of child development proposed by Piaget which will be discussed in Chapter II. The Science 5-13 project, as Harlen (1975) indicates, both endorsed and promoted discovery learning in science.

In 1973 the Schools Council initiated a further project in primary science which was later published under the title "Match and Mismatch" (Harlen et al, 1977). The project aimed to help teachers to provide pupils with work in science which would extend their learning and permit progress to be monitored. The project identified three types of information which teachers needed to enable them to match children's experiences in science to their abilities and ideas, namely:

- the child's stage of development,
- realistic goals for each stage of development,
- appropriate activities and approaches.

The project leaders themselves acknowledged (Harlen et al, 1977) that the process of matching was an uncertain one, even when teachers had all the information deemed necessary by the project team.

As the Association for Science Education (1981) indicates the Nuffield Junior Science project, Science 5-13 and 'Match and Mismatch' together apparently provided

primary teachers with everything they needed to teach science effectively. The projects provided a framework for teaching science which was related to statements of aims and objectives for different stages of development, guidance on monitoring children's progress and ideas for teaching resources. The HMI survey of primary education (DES, 1978) highlighted, however, the disappointing progress of science despite the developmental work and innovative ideas and materials produced by the Schools Council projects. The projects, HMI stated:

"have had little impact in the majority of schools."

(DES, 1978, par 5.82)

Gordon and Lawton (1978) suggest that one of the reasons for the lack of impact of the primary science projects was related to the general problem of diffusion of innovative ideas; too few teachers had heard about Science 5-13. A further, related reason, was the lack of unified and ongoing in-service programmes for teachers (INSET), in spite of active teachers centres in some areas; this view is supported by recommendations for increased inservice provision by HMI in 1978. HMI identified another, equally important, factor which was related to teachers' own lack of expertise in science. Many primary teachers lacked confidence in their ability to teach science, and therefore avoided teaching the subject. Those teachers who taught science were often unsure about what to teach or how to develop topics, HMI identified one outcome as superficial work which lacked direction. HMI recommended that teachers with science expertise should be carefully deployed to

support the development of science in their schools.

The HMI survey (DES, 1978) produced damning evidence concerning the inadequate provision for science and health education in primary schools. HMI found that in twenty per cent of the schools no science was being taught. Forty-three per cent of schools had schemes of work for science but there was little evidence that these schemes were being implemented. Even fewer schools, seventeen per cent, had schemes of work for health education. HMI found evidence that where schools had teachers with special responsibility for particular subjects who were able to plan and to implement programmes of work this was an effective way of raising standards of work. However, only seventeen per cent of all primary schools had teachers with such responsibility for science, although seventy per cent had teachers with responsibility for music and forty-eight per cent for games. The numbers of schools with posts of responsibility for health education are not cited.

HMI commented also on methods used for science teaching. They observed that key scientific concepts were given insufficient coverage; teaching of process skills, such as observation and the formulation of hypotheses, experimentation and recording was often superficial. HMI noted that work in science was less well matched to the children's capabilities than was work in any other area of the curriculum. The opportunities for science were present, albeit unrecognized; the majority of primary classrooms had interest tables and living material, such as small mammals and half of the schools sampled used visits

as a basis for topic work.

As a result of the survey HMI made a series of recommendations which stressed the need for suitably trained teachers and the importance of ongoing INSET provision, in particular training for teachers with posts of responsibility. HMI suggested that in science:

"slow but steady build up from points of strength of individual teachers is probably the only sure way forward." (DES, 1978, par 8.65)

HMI recommendations about science education, including the training and support of teachers in primary schools, were particularly significant and led to the development of INSET programmes which are discussed in detail in Chapter III.

Evidence to support HMI findings on science education in primary schools came from the first report of the Assessment of Performance Unit (APU) on science at age 11 (Harlen et al, 1981). The APU had been set up in 1975 within the Department of Education and Science with the stated purpose of promoting the development of methods of assessing and monitoring the achievement of children in schools in specific areas, which included English, mathematics, science and personal and social development; some areas from the original list, including the important area of personal and social development, were never monitored fully. The formation of the APU was viewed with considerable misgivings by many educators. One reason for this concern is identified by Gipps and Goldstein (1983) in their evaluation of the APU when they suggest that the

setting up of the unit provided the DES with a means of evaluating and influencing the content of the curriculum. A further concern identified by Gipps (1986) was that of teachers who saw the process as one of identifying teacher competencies.

The author considers that despite the concerns expressed about the APU and criticisms of its methods (Gipps and Goldstein, 1983) there were benefits for science education. As Gipps and Goldstein point out the science team saw their role primarily as one of innovatory research rather than as a process of monitoring and this influenced both their methods of working and the outcomes of their research, including their interpretation of the results. Underlying their work was a view of science as a rational approach to problem solving rather than merely a discrete body of knowledge. The processes of science were as important as knowledge and understanding but, the team recognized, could not be assessed independently of the contexts in which that science was taught. The APU science team provided detailed information about children's achievements in science at ages 11, 13 and 15 but, equally important in the author's view, it identified models of what might constitute good practice in science education.

The APU science team carried out five surveys of children at age eleven between 1980 and 1985, publishing a series of annual reports (Harlen et al, 1981; 1983; 1984 and 1985) allied to shorter digests on specific topics (for example Harlen, 1983; 1986) and summary documents which described the methods used and findings from the five

surveys (APU, 1989a; 1989b). The stated intention of the APU had been to select pupils for testing from the entire population irrespective of their experience in science. The findings indicated that although primary teachers were developing some scientific skills effectively, including observation, they were less successful in promoting other important skills, for example, those required in planning and undertaking scientific investigations.

By the beginning of the nineteen eighties there was a developing consensus amongst science educators about the importance of including science as part of the primary school curriculum. To the ferment of primary education identified by Bassett (1971) there was added the ferment of primary science education. The value of science as part of the learning experience for all children was acknowledged and consideration was given to what types of science experience might be most appropriate. Pressure for the inclusion of science in the primary curriculum came from the work of the Schools Council, HMI and from the influential Association for Science Education (ASE).

Until the nineteen seventies the ASE had been concerned almost exclusively with science in secondary schools. In 1971 it produced a booklet on 'Science for the under thirteens' (ASE, 1971) which was to herald the beginning of a growing commitment to primary science. The booklet on posts of responsibility (ASE, 1976), subsequently revised and reissued in 1981 (ASE, 1981), provided detailed guidance on the role and responsibilities

of post holders in science which was to prove particularly helpful following the publication of the HMI report (DES, 1978). Two ASE publications, 'Alternatives for Science Education (ASE, 1979) and their policy statement, 'Education through Science' (ASE, 1981), which emphasized the need for a coherent policy for science for children from 5 to 16 years, were to inform and to influence later legislation (DES, 1989a). The ASE made recommendations and proposals which covered both the place of science in the curriculum and the development of science; they also considered what they termed the 'pedagogic implications of science for all' (ASE, 1981,p.4) which included reference to the need for greater self-evaluation by teachers, and resource provision. The Association urged all those involved in science education, including LEAs and training institutions, to commit resources and expertise to the support of science, including the training of teachers; the ASE itself was later to support the development and accreditation of courses in primary science.

The need for support and guidance for primary schools developing schemes of work in science was evident to all those engaged in science education: both were forthcoming by 1984. The Schools Council Learning through Science Project, which was initiated in 1978, was the successor to the primary projects discussed earlier. The project produced materials designed to help schools to plan and to implement school policies for science (Learning Through Science, 1980;1982) allied to sets of pupil materials. The pupil materials supported teachers who were uncertain about

teaching science by presenting children with activities, which were designed to form starting points for scientific investigations, and by providing guidance for teachers on how to extend the activities further.

In 1983 the DES (DES, 1983b) provided additional funding for in-service provision for coordinators of science in primary schools, which is discussed in detail in Chapter III. The DES also signalled that science in primary schools would receive Educational Support Grant funding from 1985. HMI, in the same year, published a discussion paper 'Science in Primary Schools' (DES, 1983a) which proposed a framework for science in primary schools based on current ideas of teaching and learning in science which emphasized the development of the "processes of scientific thinking" (DES, 1978, section 1), for example, observing, experimenting, applying and communicating. The paper stressed the importance of continuity and progression in science from five years onwards and provided limited guidance on how these objectives could be achieved. Advice was also given on the construction of schemes of work which were related to examples of good practice. Four aspects of science were identified for study:

- i. living things and their interaction with the environment,
- ii. materials and their characteristics,
- iii. energy and materials,
- iv. forces and their effects.

These headings were very broad and allowed teachers considerable flexibility in developing their own schemes of

work; the first three of these areas encompass topics related to the study of nutrition.

The author's work with primary teachers at that time revealed that there was still a reluctance on the part of many primary teachers to engage in science, for the reasons which HMI had identified in 1978 (DES, 1978); this perception was one shared by colleagues in London and elsewhere. There were indications, however, that science was being taught more widely. Evidence from the APU survey of science at age 11 (DES, 1983c) showed that ninety per cent of schools sampled in 1983 signified that science was part of the curriculum, about fifty-five per cent of the schools had a member of staff with responsibility for science; these findings were encouraging as they indicated a growing acceptance of the importance of science.

The penultimate stage in ensuring that science became part of the curriculum for all children was, the author suggests, the publication of "Science 5-16: A statement of policy" (DES, 1985a). This publication set a precedent; it was the first subject specific statement of policy published and it covered the whole age range from five to sixteen years. The statement of policy developed ideas which had been set out in a DES consultative paper on science education (DES, 1982) which had suggested that science should be considered as a continuum from 5 to 16. The recommendations for science for primary schools in the policy statement were almost identical to those outlined by HMI in 1983 (DES, 1983a) and restated the need for in-service provision of the type which is discussed in Chapter

III. The proposals for science were based on ten 'principles':

1. breadth,
2. balance,
3. relevance,
4. differentiation,
5. equal opportunities,
6. continuity,
7. progression,
8. links across the curriculum,
9. teaching approaches,
10. assessment.

Many of the issues raised under these headings had an importance which went beyond science. Echoes of the principles are to be found in other DES publications which were produced during the same period, for example "Better Schools" (DES, 1985b), and in those published subsequently (for example DES, 1989). Issues of equal opportunities, which included an entitlement to science for all pupils, were of particular importance in the context of recommendations by the influential Swann Report, 'Education for All' (DES, 1985) which identified the responsibilities of schools in meeting the aspirations of cultural minorities.

Science was described as a "practical subject" (DES, 1985, par 13) and emphasis was placed on the development of practical, investigative and problem solving approaches to science. The importance of maintaining a balance between scientific knowledge and the processes of science was

stressed. Methods of assessment were advocated which "recognized the importance of skills and processes of science" (DES, 1985a, par13.) and which allowed pupils to show what they could do. The importance of making links across the curriculum was also stressed.

The policy statement represented the culmination of a process of debate amongst science educators about the purposes and nature of science in schools. In general the recommendations were welcomed. There was agreement about the importance of science as an integral part of the curriculum in primary schools and of the model of science outlined in the policy statement.

The focus on science in the previous paragraphs reflects in part the rapid changes in the provision and importance of science in the primary curriculum in the past twenty years. There have been equally important changes, however, in other areas of the curriculum where nutrition education takes place, particularly health education. The Schools Council science development projects described earlier, for example Science 5 - 13, were paralleled by those in Health Education. The Schools Council Health Education 5 -13 project (SCHEP, 1977) which was set up in 1973 was instrumental in promoting very different attitudes to teaching health education from those which had been prevalent in the post war era.

The DES Handbook on Health Education (1977) says little about health education as part of the primary curriculum and provides little guidance for primary teachers, other than commenting that approaches used in

primary schools were appropriate for health education. As Johnson (1981) points out the view of health education promoted in the handbook was of the child as a 'passive recipient'. The lack of emphasis on health education in primary schools is also evident from the HMI survey (DES, 1978) discussed earlier. HMI observed that:

"Health Education is neither recognised, nor recognisable, in the school curriculum But health education is unavoidable, even if its presence is denied ..."

(DES, 1978, p.29)

HMI's comments support Johnson's assertion that much health education was going on in schools at that time within topics such as food and in response to questions from children although, as HMI pointed out, only seventeen per cent of schools sampled had planned schemes of work.

By the mid-nineteen seventies there was growing evidence that children's attitudes to health were formed early in their school career. The work of, for example, Jahoda and Crammond (1972) on children's attitudes to the consumption of alcohol and that of Bewley (Bewley et al, 1975) on children's attitudes to smoking supported the argument of Williams (1976), who was director of SCHEP 5-13, that health education in primary schools was of fundamental importance in establishing informed understanding of health issues.

The early research by SCHEP showed, Johnson (1981) indicates, that teachers found it easier to discuss health education in terms of content than to identify aims and appropriate methodology. Teachers did not always recognise

that discussion of issues related to health with children could be more influential in helping to promote positive attitudes to health than didactic teaching. This finding is not unsurprising if considered in the context of the HMI survey (DES, 1978) which had shown that the majority of primary teachers used a didactic approach. If the broad aims of SCHEP, which included the development of knowledge, skills and attitudes in relation to health (Schools Council, 1977), were to be achieved schools and teachers required support in planning and developing new approaches to teaching.

The SCHEP team, as Johnson (1981) indicates, advocated that health education should be planned and sequential and that teachers should be appointed with responsibility for health education. The materials produced provided guidance on the types of topics which could be included as part of health education, these included work on diet and health. Although, as Johnson indicates, teachers were enthusiastic about the materials the project failed to have the hoped for impact on health education in primary schools. The author suggests that SCHEP 5-13 'failed' for similar reasons to those discussed earlier in relation to Science 5-13 and that the model of health education promoted by SCHEP 5-13 was to influence curriculum development in health education in much the same way as Science 5-13 influenced science.

Evidence about the extent of health education in primary schools in the period following the HMI survey (DES, 1978) comes from research by Wilcox and Gillies

(1981) in Sheffield. Wilcox and Gillies found that aspects of health education were taught in all of their sample of 728 classes bar eight. For all age groups health education was largely incidental with elements appearing in a wide range of curriculum areas, for example science. Just over twenty per cent of health education was taught as part of discrete themes or topics. Teaching about aspects of nutrition, generally as part of cookery, occurred in at least forty per cent of classes of all ages. Wilcox and Gillies point to the inherent dangers in unplanned and uncoordinated health education programmes, which include repetition and lack of progression. Whilst acknowledging the importance of incidental teaching they recommended that schools should identify a core of health topics which children would encounter in a sequenced way from five to eleven years.

Throughout the nineteen eighties the emphasis in health education was on the development of skills and the promotion of positive attitudes to health. This emphasis is apparent in publications by the Health Education Council (for example HEC, 1983) and HMI discussion papers (DES, 1986). HMI outlined the tasks for schools as:

"to support and promote attitudes, practices and understanding conducive to good health ..."(DES, 1986)

Health education was viewed by HMI as a cross-curricular area not a separate subject. HMI stressed the importance of ensuring that cross-curricular areas were planned for by schools and that schemes of work were developed. Teaching about food and diet formed one area of

health education. Important aspects of nutrition education identified by the Health Education Council (HEC, 1983) included:

- nutritional needs,
- eating habits,
- food and dental health,
- food preservation,
- choosing food.

One of the interesting outcomes of the focus on science in the nineteen eighties was the linking of health education to science. This phenomenon is evident in the work of the Secondary Science Curriculum Review, which was set up in 1981, and received support from the Health Education Council. The review's final report on health education and science considers health education in both primary and secondary schools (SSCR, 1987). The review endorses suggestions by HMI (DES, 1986) and the HEC (1983) about the teaching of health and nutrition education, including the need for health education to promote skills, including those needed to make informed decisions about diet and health, and positive attitudes.

The last part of this review of primary education in the post war period has considered the changes which took place in science and health education in the early and mid-nineteen eighties. These changes reflected changing political priorities as well as changes in educational thinking. Major funding, for example through Education Support Grants, was provided for the development of certain areas of the curriculum in primary schools, most notably in

science and technology. One outcome was the provision of new forms of in-service provision which are discussed in Chapter III. The decade ended with more fundamental and far reaching change than any since the Education Act of 1944 and with a furore which centred on the provisions of the Education (Reform Act) 1988, including the introduction of a "National" Curriculum.

1.2.4. Science, technology and health education as part of the National Curriculum in England and Wales

During the nineteen eighties the curriculum became increasingly an area of public debate and concern. This debate, as Pring (1989) observes, was initiated by a keynote speech in 1976 by the then Prime Minister, James Callaghan, and was to lead to the publication of a series of consultation and policy documents by the DES, including those concerned with science and health education which were discussed in the previous section (DES, 1983, 1985a, 1986). A noteworthy feature of the publications by the Secretary of State for Education and HMI documents was the differing views of the curriculum which they revealed.

In 1977 HMI (DES, 1977a) called for a core curriculum which was capable of responding to the needs of a pluralist society. The curriculum envisaged was one based on 'areas of experience', for example the scientific and the ^{human and} social.

None of the areas, HMI suggested, should be thought of in terms of subjects although they recognised that in some areas certain subjects would contribute a

major part. This view was qualified by HMI in 1980:

"The curriculum, whether for schools as a whole or for individual pupils, has to be presented as more than a series of subjects and lessons in the timetable."
(DES, 1980a p.3)

For the DES the curriculum came to be defined in terms of subjects, as is evident from publications from 1980 onwards (DES, 1981,1985c,1985d). The justification for focussing on subjects was not premised on educational theory, or the needs of the child, but on the traditional construction of secondary school timetables and the recognition of subject titles by parents and employers (DES, 1980a). A further important feature of DES publications (for example DES,1985c, 1985d) was the emphasis on 'standards' allied to a curriculum which was broad, balanced, relevant and differentiated according to pupils' abilities and aptitudes. "Better Schools" (DES, 1985c) marked a further step towards government policy which would lead to the establishment of a national curriculum for England and Wales as part of the provisions of the Education Reform Act of 1988. This view is supported by Pring (1989) who suggests that the legislation of 1988 was the culmination of a process in which the government sought to control the curriculum more directly from the centre.

The Education Reform Act 1988 included wide ranging provisions which affected both the curriculum for pupils from 5 to 16 years and the way in which schools were managed and financed; the power and role of LEAs was

reduced. One of the most significant and important provisions of the Act, in the author's view, was the power invested in the Secretary of State for Education 'to give orders' (Education Reform Act, 1988) specifying:

- attainment targets and programmes of study for each subject,
- assessment arrangements.

Two new bodies were formed by the government to oversee and to monitor the implementation of the national curriculum, the National Curriculum Council (in England) and the Schools Examination and Assessment Council (SEAC) which was to be responsible for the assessment arrangements for children at ages 7, 11, 14 and 16 (Keystages 1 to 4). Although in theory the Secretary of State follows advice from the NCC and SEAC, in practice, as Pring (1989) indicates, s/he is under no obligation to follow that advice. The 1988 Act thus gives the Secretary of State much greater control in determining the objectives and nature of the curriculum than any previous Secretary or Minister of Education. The Act, however, does not prescribe how pupils should be taught.

The curriculum defined by the Education Act 1988 is a collection of discrete subjects, which, as Aldrich (1988) and Pring (1989) point out bear a remarkable likeness to the 1904 regulations for secondary schools! The subjects include science and technology, with science forming one of three core subjects alongside English and Mathematics. Health education is not recognised as a subject although provision for health education is implicit in provision

under Section 1 of the Act which places a statutory responsibility upon schools to provide a broad and balanced curriculum. There was concern that health education might be marginalised, as was noted by the author at the time (Turner, 1989b). These concerns have been partially allayed by the subsequent publication of curriculum guidelines for health education by the National Curriculum Council (NCC, 1990b) in which health education is incorporated as one of five-cross curricular themes which are viewed as an integral part of the curriculum.

There were two key elements in the development and implementation of the national curriculum which are of particular relevance to nutrition education. The first of these elements was the report by the Task Group on Assessment and Testing (DES, 1988b), the so called TGAT report, which provided guidance on the development of assessment procedures. The second element was the production of detailed programmes of study and attainment targets for specific subjects, such as science, by working groups appointed by the Secretary of State.

The TGAT (DES, 1988b) report was based on what was identified as established good practice. Assessment, the report suggested, should provide a framework:

"in which educational objectives may be set, and pupils' progress charted and expressed."

(DES, 1988b, par.3)

Assessment was viewed as an integral part of the teaching and learning process, something which could be used as a means of diagnosing pupils' needs, and which

would facilitate dialogue between teachers and thus enhance professional development. The report emphasised that procedures developed for national assessment should be:

- i. criterion referenced - to "give direct information about pupils' achievement in relation to objectives" (par.5),
- ii. formative - to support learning by providing a means of diagnosing pupils' needs, results should be presented as an attainment profile,
- iii. moderated - to facilitate comparisons across classes and schools,
- iv. related to progression.

At the present time it is still not clear how fully the recommendations made by TGAT will be implemented. Much time, effort and money has been spent since 1988 in developing assessment procedures, including teacher assessment and externally administered Standard Attainment Tasks for seven year olds (Key stage 1), however, the long term assessment arrangements remain uncertain.

As both the TGAT Report (DES, 1988b) and Gipps (1988) point out assessment in primary schools is not new, a wide variety of assessment methods including LEA administered tests have been used for many years. Assessment of science in primary schools has, however, never been undertaken on the scale envisaged by the 1988 Education Act. This factor, allied to the recent and rapid expansion of science teaching in primary schools noted earlier, is of particular importance. Primary teachers were faced in September 1989 with what, to many, was the daunting challenge of both

teaching and assessing science as part of the national curriculum; some of the ways in which primary teachers were helped to meet this challenge are discussed more fully in later chapters.

The development of appropriate programmes of study and attainment targets for each subject was assigned to Working Groups appointed by the Secretary of State. Each of these working groups produced interim consultation documents prior to making their recommendations to the Secretary of State; this process of consultation and debate ensured that, at least in principle, the programmes of study reflected an informed consensus view. In practice the timescale allowed for the production of reports and for consultation was very short and served to militate against wide ranging and considered debate. The timescale was determined by the decision to start the phased implementation of the so called core and foundation subjects of the national curriculum in the autumn of 1989. The requirement for working groups to designate ten levels of attainment within individual attainment targets for the purposes of assessment proved controversial. Indeed the Science Working Group (DES, 1988a) in its final proposals to the Secretary of State declined to specify ten progressive statements of attainment for skills independently of the supporting statements of attainment for knowledge and understanding in science.

In its original brief the Science Working Group was asked to consider science and technology 5 to 11 and science from 11 to 16 years. Technology was later assigned

to a separate Technology Working Group and therefore science and technology will be considered separately in the following review of aspects of nutrition education which are included in the national curriculum. At primary level, where topics such as food are generally taught in an integrated way, the distinction between the separate subjects frequently becomes blurred. There are, however, important differences between the purposes of science and technology, which were identified by the Science Working Group (DES, 1988a). Science is concerned with the "pursuit of reliable knowledge" about the world, although it may utilise and be dependent upon technology. Technology is "led by human needs and involves meeting those needs or solving identifiable problems" (DES, 1988a) using relevant knowledge from many disciplines.

In their final report the Science Working Group (DES, 1988a) stressed the importance of developing children's investigative skills and of recognising their ideas. They emphasised also the role of the teacher as an enabler in the learning process, something which is considered in more detail in later chapters.

The final statutory orders for science (DES, 1989) included programmes of study for each Key stage and attainment targets (ATs) in which ten levels of attainment were specified. The attainment targets are listed in Figure 5 alongside the revisions proposed by the DES in May 1991 (DES, 1991a). From Figure 5 it can be seen that AT1, which in the statutory orders (DES, 1989a) forms a separate profile component, is related to the exploration of

Figure 5

Science in the National Curriculum - Attainment Targets

AT	Attainment targets - 1989	Proposed new attainment targets - June 1991	NAT
1	Exploration of science	Scientific investigation	1
2	The variety of life	Life and life processes	2
3	Processes of life		
4	Genetics and evolution		
5	Human influences on the earth	Materials and their behaviour	4
6	Types and uses of materials		
7*	Making new materials		
8*	Explaining how materials behave		
9	Earth and atmosphere	Earth and environment	3
10	Forces	(Scientific investigation)	5
11	Electricity and magnetism		
12	The scientific aspects of information technology including microelectronics		
13	Energy	Energy and its effects	5
14	Sound and music	(Earth and environment) (Scientific investigation)	
15	Using light and electromagnetic radiation		
16	The earth in space		
17*	The nature of science		

Source: DES (1989) Science in the National Curriculum
 DES (1991) Science for ages 5 to 16 (1991)

* Do not apply to key stages 1 and 2

science; the other ATs are concerned with knowledge and understanding. The importance of scientific investigation is emphasised by the recommended weightings, for example, at Key stage 1 the weighting for AT1 is 50%.

The sections of the programmes of study for Key stages 1 to 3 and statements of attainment in science which relate to teaching about food are summarised in Figures 6 and 7 alongside the proposed revisions (DES, 1991a). From Figure 6 it is apparent that coverage of the topic in the programmes of study is extensive, also that the proposed revisions (DES, 1991a) omit some important elements, for example providing children with opportunities to talk about what they eat and to think about their reasons for eating. The summaries indicate also the overlap with other subjects, for example geography.

Technology in the national curriculum is conceived as an approach rather than a discrete subject; it incorporates subjects such as home economics, makes links with other subjects including science and contributes to cross-curricular themes such as health education (DES, 1990). The programmes of study, with their associated suggestions for starting points and activities, provide numerous opportunities for work on food, for example discussing school meal preferences (Key stage 2). Further suggestions for activities are provided in the attainment targets, for example, finding out how the school cook chooses menus for school dinners (AT1, level 2). Attar (1990) suggests that the recommendations by the Design and Technology Working Group (DES, 1988c) were like a "breath of fresh air" and

Figure 6

Nutrition education in the National Curriculum - summary of provision in programmes of study in science
Key stages 1 to 3

Key stage	Programmes of Study - September 1989	Programmes of study - proposed revision June 1991
KS1	<p>Children should: be finding out about themselves, developing their ideas about how they grow, feed ... be introduced to ideas about how they keep healthy ...</p> <p>consider similarities and differences between themselves and other children. collect, and find similarities and differences in, a variety of everyday materials, natural and manufactured, including cooking ingredients.</p> <p>explore the effect of heating everyday substances e.g. chocolate</p> <p>Children should consider the foods they eat and why they eat them. They should talk, or communicate by other means, about what they eat, and why and when they eat.</p>	<p>Children should: be finding out about themselves, developing their ideas about how they grow, feed ... be introduced to ideas about how they keep healthy through exercise ... diet consider similarities and differences between themselves and other children ... collect, and find similarities and differences in, a variety of everyday materials ... natural and manufactured materials such as cooking ingredients... explore the properties of these materials referring e.g. to their shape, colour and texture; ... see how some can be changed by simple processes such as dissolving, squashing, pouring, bending and twisting. explore the effects of heating some everyday substances ...e.g. chocolate ... also encounter materials such as bread ... which change permanently on heating</p>

Key stage	Programmes of Study - September 1989	Programmes of study - proposed revision June 1991
KS2	<p>Children should: investigate some aspects of feeding... in relation to themselves and other animals... be introduced to functions of main organ systems... explore ways in which good health can be promoted in relations to their own daily routine ... investigate physical factors on the rate of plant growth...</p> <p>study aspects of local environment affected by human activity e.g. farming</p>	<p>Children should: investigate some aspects of feeding ... in relation to themselves and other animals... be introduced to the major organs and organ systems... learn about the factors which contribute to good health, including ... diet, oral hygiene and exercise investigate the effects of physical factors on the rate of plant growth ... be introduced to food chains ... consider role of climate on the productivity of agriculture</p>
KS3	<p>Pupils should: study life processes, food and feeding (including digestion and assimilation) ... particularly as they relate to human beings. ... investigate the requirements for photosynthesis... uses of enzymes and microbes e.g. in the baking, brewing and dairy industries.... study ...ways in which healthy functioning of human body may be disrupted by diet, lifestyle ...</p>	<p>Pupils should: study life processes, food and feeding (including digestion and assimilation)... particularly as they relate to human beings. ... investigate the requirements for photosynthesis ... uses of enzymes and microbes e.g. in the baking, brewing and dairy industries... study... ways in which healthy functioning of human body may be promoted or disrupted by diet, lifestyle... study effects of human activity, including food production...</p>

Source - DES (1989) Science in the National Curriculum and DES (1991) Science for ages 5 to 16 (1991)

Figure 7

Nutrition education in the National Curriculum - summary of relevant statements of attainment in science (levels 1 to 5)

Level	Statements of attainment - Sept.1989	Proposed new statements of attainment - June 1991
1	<p>Pupils should:</p> <ul style="list-style-type: none"> * know that there is a wide variety of living things, which includes human beings (AT2) * be able to name or label the external parts of the human body/plants (AT3) * know that human beings vary from one individual to the next (AT4) * know that human activities produce a wide range of waste products (AT5) * be able to describe familiar and unfamiliar objects in terms of simple properties e.g shape, colour, texture (AT6) * understand that they need food to be active (AT13) * be able to describe ... how food is necessary for life (AT13) * be able to describe ... the seasonal changes which occur in the weather and living things (AT16) 	<p>Pupils should:</p> <ul style="list-style-type: none"> * know that there is a wide variety of living things, which includes humans (NAT2) * be able to name or label the external parts of the human body and the flowering plant (NAT2) * be able to identify familiar and unfamiliar objects in terms of simple properties (NAT4) * know that they need food to stay alive (NAT2)

Level	Statements of attainment - Sept.1989	Proposed new statements of attainment - June 1991
2	<ul style="list-style-type: none"> * know that plants and animals need certain conditions to sustain life (AT2) * know that personal hygiene, food, exercise ... are important (AT3) * be able to give a simple account of the pattern of their own day (AT3) * be able to keep a diary, in a variety of forms, of change over time (AT5) * be able to recognise important similarities and differences in the characteristics of materials (AT6) 	<ul style="list-style-type: none"> * know that living things need certain conditions to sustain life (NAT2) * be able to sort natural materials into broad groups according to directly observable features (NAT3)
3	<ul style="list-style-type: none"> * be able to recognise similarities and differences among living things (AT2) * be able to sort living things and natural materials into broad groups according to observable features (AT2, AT 9) * know that living things respond to seasonal and daily changes (AT2) * know that the basic life processes: feeding ...behaviour, are common to human beings and other living things they have studied (AT3) * know that some materials occur naturally while many are made from raw materials (AT6) 	<ul style="list-style-type: none"> * be able to sort living things into broad groups according to easily observable features (NAT2) * know that the basic life processes are common to humans and other living things they have studied (NAT2) * know that some materials occur naturally while many are made from raw materials (NAT4) * know that green plants use sunlight to make food * know that human activity may produce local changes in the environment which can affect animals and plants (NAT2)

Level	Statements of attainment - Sept.1989	Proposed new statements of attainment - June 1991
4	<ul style="list-style-type: none"> * understand the key factors in the process of decay (AT2) * be able to name the major organs and organ systems in flowering plants and mammals (AT3) * know about the factors which contribute to good health and body maintenance ... balanced diet, oral hygiene..(AT3) * be able to describe the main stages of flowering plant reproduction (AT3) * know that climate determines the success of agriculture (AT9) 	<ul style="list-style-type: none"> * be able to name the major organs and organ systems in flowering plants and mammals (NAT2) * understand food chains as a way of representing feeding relationships in an ecosystem
5	<ul style="list-style-type: none"> * be able to support their view about environmental issues concerned with the use of fertilisers in agriculture and horticulture, based on their practical experience (AT2) * know that living things are made up from different kinds of cells which carry out different jobs (AT3) * understand malnutrition and the relationships between diet, exercise and health, fitness and circulatory disorders (AT3) * know that in digestion food is made soluble so that it can enter the blood (AT3) * understand the way in which microbes and lifestyle affect health (AT3) * be able to describe the functions of the main organ systems 	<ul style="list-style-type: none"> * be able to describe the functions of the major organ systems in flowering plants and mammals

Source: DES (1989) Science in the National Curriculum
DES (1991) Science for ages 5 to 16 (1991)

opened the way to more imaginative ways of working with and learning about food; these opportunities are present also in the final provisions for technology (DES, 1990).

As mentioned earlier, teaching about food occurs also as part of health education, one of the cross-curricular themes identified by the National Curriculum Council (NCC, 1990a). Food and nutrition is one of nine components in the framework for health education proposed by the NCC (NCC, 1990b). Nutrition education as defined by the NCC includes study of:

- the relationships between diet and health,
- the nutritional quality of different foods,
- food safety,
- food choices and health.

The differences between this list and that cited earlier from the Health Education Council (HEC, 1984) are interesting and reflect, it appears, changing perceptions about diet and health, which are discussed in section 1.4, allied to changing priorities and concerns about food safety.

The NCC guidelines on health education (NCC, 1990b) place emphasis on the encouragement of individual responsibility and informed decision making. The NCC draws attention also to the need for careful selection of teaching methods which permit active participation by pupils, including discussion of issues, and opportunities for pupils to assess evidence, to negotiate and to solve problems. The skills cited are similar in many respects to those listed for science. The teaching approaches

advocated are similar to those advocated by, for example, SCHEP (Johnson, 1981) which were discussed in the previous section (1.2.3).

The NCC guidelines make suggestions about appropriate areas for study for each key stage, those for food and nutrition are listed in Figure 8. It seems to the author that some of the areas for study identified, notably those concerning nutrients at key stage 2, may be unrealistic and inappropriate; this issue is one which will be returned to and examined in more detail in subsequent chapters.

The Education Reform Act 1988, through the provisions for science and technology and the proposals for cross-curricular themes, particularly health education, provides the potential for teaching about food and diet to occur in a planned and systematic way which facilitates progression and continuity. The author regards the emphasis on the development of skills in science, technology and health education, allied to the promotion of teaching strategies which provide opportunities for active participation by pupils, as being one of the most positive outcomes of recent initiatives in education.

Figure 8

Guidelines for teaching about food and nutrition in the national curriculum - key stages 1 to 3

Key stage	Suggested areas of study for food and nutrition
1	<ul style="list-style-type: none"> * know that there is a wide variety of foods to choose from and that choice is based on needs and/or culture; * know that food is needed for bodily health and growth and that some foods are better than others
2	<ul style="list-style-type: none"> * know that a diet is a combination of foods, each with a different nutrient content; * know that different nutrients have different effects on the body, and the amounts in the diet, and balance between them, can influence health, e.g. sugar and dental health; * know how to handle foods safely and recognise the importance of additives in food safety. * know about different cultural practices ... in food handling; * know about the factors which bring about dental decay...
3	<ul style="list-style-type: none"> * know that individual health requires a varied diet; * understand malnutrition and the relationships between diet, health, fitness and circulatory disorders; * understand basic food microbiology, food production and processing techniques; * understand the impact of the media and advertising on attitudes towards health.

Source: National Curriculum Council (1991) Curriculum Guidance 5 Health Education

1.3 PUBLIC HEALTH AND SOCIAL POLICY

The review of education policy in the previous section drew attention to the social provisions of many of the Education Acts, for example those concerning school meals and medical inspections. Such provision is, in the author's view, an important factor in nutrition education as part of the nutritional career of the individual, which is identified in Figure 1, and one which merits more detailed consideration.

One of the outcomes of the implementation of the Education Acts of 1870 and 1880 discussed earlier was the revelation of the extent of poverty and malnutrition amongst children. As the preamble to the Court Report (Committee on Child Services, 1976, 3.11) points out, many children at the end of the nineteenth century were unable to benefit from schooling because they were undernourished and suffered from recurrent illness which, to some extent at least, was a consequence of malnutrition. The work of individual social reformers, allied to government policy, to rectify the problem of malnutrition in children forms the focus of the initial part of this section. In schools the provision of school health services and school meals, which stemmed from the desire to prevent malnutrition, are amongst the changes which have occurred as a result of the development of public health and social policy during this century: these aspects of provision in schools are considered in sections 1.3.2 and 1.3.3.

From the middle of the nineteenth century there was

increasing public concern about issues of public health and poverty. Bruce (1973) suggests that this concern reflected greater public awareness of the realities of poverty. It is significant that government policy from that time began also to address the causes of poverty. Bruce identifies the Fourth Annual Report of the Poor Law Commissioners in 1838 as the beginning of a "national movement of concern about public health." (Bruce, 1973). Over the following one hundred years this developing concern about public health and poverty was to become a consistent feature of subsequent health and social policy, culminating in the Beveridge Report (1942) which was to be instrumental in creating the Welfare State.

1.3.1 The influence of social reformers

The latter part of nineteenth century was characterized by the influence of groups, such as the Fabian Society, and individuals, for example Sidney and Beatrice Webb, who pressed for social reform. Their influence can be seen in all aspects of social reform including the Factory Acts, which were to end the exploitation of child labour and to pave the way for the entitlement to elementary education embodied in the Education Act of 1870.

One of the most important groups was the Fabian Society, founded by Hubert Bland in 1884. Many members of the Fabian Society, including Sidney and Beatrice Webb, have had lasting influence on many aspects of public

health, social policy and education. For example, Sidney Webb was instrumental in effecting change in technical education in London at the end of the nineteenth century and in promoting the Education Acts of 1902 and 1903.

At the end of the nineteenth century there were two very important social surveys which provided information about the life of people, particularly the poor, in cities. The work of Booth in London (Booth, 1902) and Rowntree in York (Rowntree, 1901), which is discussed in Section 1.4, was of particular significance in demonstrating that poverty was the result of social and economic conditions, over which individuals had no control, rather than ignorance or bad management.

One of the outcomes of the work of the social reformers, including the Webbs, Booth and Rowntree, was the Minority Report of the Poor Law Commission. The Royal Commission on the Poor Law was set up in 1905 to investigate the working of the Poor Law and to make suggestions about how it should be amended.

When the Royal Commission reported in 1909, the report contained two sections the so called Majority Report and the much better remembered Minority Report which was based on the recommendations of the Webbs. The Fabian Society also published an annotated version of the Minority Report to influence public opinion. Clarke (1949) argues that the Minority Report was brilliant in conception and anticipated the content of social legislation for the following forty years. The report was based on the concept that poverty had diverse causes which had to be identified

before they could be treated effectively. The Webbs, Clarke indicates, considered that poverty was a social challenge, rather than a personal problem, and that the various aspects of poverty should be tackled by specialist provision rather than the outmoded general provision of the Poor Law. The Minority Report recommended that the Board of Education, through the Local Education Authorities, should have responsibility for the education and welfare of all children, including the provision of school meals. The linking of education and welfare provision in this way was not a new idea as can be seen from, for example, the Education (Provision of School Meals) Act of 1906 and the Education (Administrative Provisions) Act (1907) which are discussed in Sections 1.3.2 and 1.3.3.

Issues of poverty in relation to diet and health were to become the focus of debate and concern amongst social reformers again in the period of the economic depression between the first and second world wars. Shardlow (1977), in his study of nutrition and social reform in the nineteen thirties, suggests that health and social class emerged as a political issue during the period prior to the beginning of the second world war as a result of the efforts of a group of physiologists, whom he calls "social nutritionists". The social nutritionists used new knowledge concerning nutrients, such as vitamins, as a basis for reconsidering and restating the links between malnutrition and poverty which had been revealed by earlier studies. Shardlow suggests that the work of these nutritionists can be regarded as part of the tradition of

liberalism which had sought to ameliorate the problems of poverty through welfare action in the previous fifty years.

The evaluation of physiological knowledge in nutrition had led to considerations of applications, namely, how to improve inadequate diets identified by, for example, the British Medical Association (BMA, 1933). The social nutritionists were critical of government for not utilising information about the health of the nation, which came from data from dietary and social surveys, in developing a national nutrition policy. The evidence from such nutritionists supported the argument for an extension of the state welfare system. Shardlow suggests that the ensuing political debate, which involved members of the medical profession whose ideas were at variance with nutritionists, arose in part from the economic and social climate during the years of the depression.

The argument between nutritionists and doctors can be linked, Shardlow (1977) suggests, to the absence of an agreed physiological definition of health. The detection of clinical malnutrition was based on comparison of the 'average' health of individuals seen by general practitioners rather than what might be regarded as 'normal'. For nutritionists 'normal' health was:

"a state of well-being such that no improvement can be effected by a change in diet."

(Orr, 1937; Chapter 11)

One outcome of the debate was the setting up of an Advisory Committee on Nutrition by the Minister of Health in 1935 which included nutrition reformers. The publication of the

social nutrition survey 'Food, Health and Income' (Orr, 1937) helped, as Shardlow points out, to ensure that nutrition became an area of public and political concern.

Boyd Orr's study (Orr, 1937) provided detailed case studies of the diet of 1,152 families, including the calorific value of the food eaten and the percentage of the income spent on food. Boyd Orr's conclusions about the diet of the poor were similar to those of Rowntree some forty years earlier, namely that malnutrition amongst the poor was the result of "economic, agricultural, industrial and commercial problems" (Orr, 1937) rather than unwise spending. Rowntree himself carried out a further survey in York in 1935 (Rowntree, 1942) and once again made recommendations for subsistence diets (Rowntree, 1937). These diets, as Walker and Church (1978) indicate, drew on the work of both nutritionists and domestic science teachers; they included 'protective foods', those containing vitamins and minerals, and recognised the importance of palatability and food choice as well as nutrients.

Boyd Orr's survey was criticised, Shardlow (1979) suggests, by those opposed to reforming nutritionists as being based on too small a sample. The validity of the study was also questioned on the grounds that one third of the families lived in industrial areas badly affected by the depression. The inadequacies of the diet of the poor which were revealed by Boyd Orr's survey were, according to Shardlow (1977), viewed as a temporary phenomenon by the government of the day which would disappear as the economic

recovery following the depression continued. The impetus for a nutrition policy was therefore lost. The factor which ultimately ensured a national policy and adequate diets for the poor was the implementation of rationing during the nineteen forties.

The way in which the social nutritionists sought to influence policy during the nineteen thirties is, Shardlow (1977) suggests, often associated with scientific debate during periods of social and political change and dislocation. Shardlow argues that although government claimed that problems concerning nutrition had been solved by 1939 what was meant was the problem of nutrition as a political threat had been solved. The argument between social nutritionists and government concerning the need for national policy for nutrition was suspended in 1939 with the onset of war, when the work of nutritionists was welcomed. Indeed academics such as Sir Jack Drummond and Lord Boyd Orr became influential figures in the new Ministry of Food. A similar debate about the need for a national nutrition policy re-emerged in the nineteen seventies and eighties. The recommendations by committees such as the National Advisory Committee on Nutrition Education (NACNE, 1983) and the Committee on Medical Aspects of Health (COMA, 1984; 1991) which are discussed in section 1.4.3, can be regarded as the latest manifestation of the debate which was initiated by the social nutritionists during the nineteen thirties.

The idea that the poor are malnourished as a result of ignorance and fecklessness continues to be mooted by

politicians, as reported in 'The Guardian' (June 4th 1991), despite the evidence to the contrary from the most recent dietary survey carried out by the Food Commission for the National Children's Home (NCH,1991). This latest survey provides information about low income families with children under five years who use centres run by the National Children's Home. The results accord with the surveys by Rowntree (1901) and Boyd Orr (1937) which indicate that poverty, not ignorance, is the major cause of diets which are deficient in terms of energy and specific nutrients. The NCH survey finds a direct relationship between those on the lowest income and those with the poorest diet.

1.3.2. The School Medical service

The introduction of elementary schooling for all children in 1870 revealed, as was indicated earlier, the extent of malnutrition amongst children from poor families at the end of the nineteenth century. Further evidence came from the surveys by Booth (1902) in London and Rowntree (1901) in York and from reports by Interdepartmental Committees such as those on Physical Deterioration (1904) and Medical Inspection and Feeding of Children attending public elementary schools (1905).

One of the outcomes of these reports, allied to concerns of social reformers about child health and the influence of the medical lobby in parliament, was the organization of a School Medical Service. As was to be

advocated later in the Minority Report of the Poor Law (1909) medical provision was to be the responsibility of the Board of Education. The Education (Administrative Provisions) Act (1907) invested in Local Education Authorities (LEAs) the duty to provide medical inspections for children when they entered school and, when necessary, at other times. The medical profession, as a Board of Education (1907) circular indicates, still maintained direct control of the service through the Medical Officer of Health.

Identification of health problems in children was only a first step, it had to be supported by treatment and the Act gave powers to the LEAs to provide treatment for those children who might not otherwise receive medical care, namely the poor.

The dental health of children was a further element in the provision of medical care. Arrangements for dental inspections were sanctioned by the Board of Education in 1909 although provision was patchy until the nineteen thirties. The DES (1975a) identifies the widespread concerns about the dental health of children at the beginning of the century and records that only seven per cent of children in Shropshire in 1911 had sound teeth.

The Education Act of 1918 strengthened the provision of the earlier Act of 1907: LEAs now had the duty to make arrangements for both the medical inspection and treatment of children in elementary schools - although most parents still had to pay for treatment. The Act of 1918 gave power to local authorities to provide nursery schools for

children from the age of two years and the notes of guidance on the "health, nourishment and physical welfare" of young children are of particular interest in the context of diet and health. The Act advised that children in nursery schools should be weighed and measured each term, which made it possible to check the nutritional status and development of children over a period of time. The Act proposed that school staff should be trained to:

"observe slight departures from the normal, which are the early indications of defects of ... nutrition."

(Education Act, 1918, Prefatory Memorandum, 9)

Emphasis was placed also on the promotion of health through such measures as the "management of the school on open-air lines".

In 1919 the relationship between the Board of Education and the School Medical Service changed, as is pointed out by the DES (1975a). The creation of the Ministry of Health in that year led to the transfer of official responsibility for medical inspection and treatment to the Minister of Health. In reality the Board of Education continued to operate as before, but on behalf of the Ministry of Health. Recommendations for the welfare of children, including medical treatment in school clinics, continued to form part of the legislation of Education Acts, as can be seen clearly in the provisions of the influential Education Act of 1944.

The welfare provisions of the Education Act (1944) need to be considered in relationship to other welfare provisions in the nineteen forties, including those

discussed in sections 1.3.3 and 1.3.4. The Act gave LEAs the duty to provide medical and dental inspection in all types of maintained primary schools and to provide treatment free of charge. Parents had a responsibility to ensure that their children were inspected. The National Health Service Act of 1948 also enabled LEAs to make arrangements for children to receive free hospital treatment.

The DES (1975a) emphasizes the importance of the role of the School Medical Service since its inception in identifying and meeting the needs of children from socially deprived homes, for example by recommending free school meals and milk. The Court Report in 1975 (CCHS, 1975) further identified the purpose of the school medical service as a means of ensuring:

"as satisfactory a standard of health as possible for every pupil so that they can make the most of their education in school."

(Committee on Child Health Services (Court Report), 1976, par 4.29)

The improving health of children during twentieth century was noted by both the (DES 1975a) and the Court Report (CCHS, 1975), as was the important role of the medical service during this period in effecting change. The DES notes the changes in nutrition which have arisen as a result of better economic conditions, school meals and, they assert, "the teaching of food values, cookery and household management" in schools. Although teaching about food values may have had some effect on the diet of young

people, this thesis will demonstrate that it is less than the DES suggests. Other factors may be equally important in determining what children eat, including the influence of peer group pressures and the media; these are considered in more detail in Chapter II. This view is supported by the Court Report which considers that an approach to health education which is based solely on facts is unlikely to be successful. The Report stresses the important role of education in maintaining and improving health through the creation of a 'learning community' (10.4) which establishes close working relationships with pupils, teachers and parents.

The Court Report was of particular significance not just because of its breadth of vision in respect of health education in schools and detailed review of provision but because it marked the reorganization of the School Health Service in 1974. From 1974 the service became part of the National Health Service and was no longer administered by LEAs. Since 1974 there have been concerns that the health needs of children have been given lower priority than in the past. The changes in provision have been monitored by the National Children's Bureau (NCB, 1987), which reported in 1987 that there had been a reduction in routine medical inspections of school children and that provision varied. The Bureau noted a widespread view that the quality of the health service was failing to meet the needs of children, parents and teachers in many parts of the country. The Bureau observed that this reduction in provision had occurred at a time when increasing numbers of children were

living in poverty. Further evidence comes from a survey by Elfer and Gatiss (1990) who argue that anticipated integration of child health services under the 1974 reorganization of the Health Service has not occurred; overall they find the provision of health care for children less satisfactory than it was in 1974.

Some of the concerns about children's health, including malnutrition, which led to the introduction of the School Medical Service may now need to be readdressed in the light of the changes that have occurred in the past ten years, including the provision of school meals which is discussed in the following section. These views are reinforced by the findings from the national survey of the diets of children of ten and fourteen years (Department of Health, 1989), which provides evidence that issues relating to diet and health have still to be resolved. These issues are discussed in more detail in sections 1.3.4 and 1.4.

1.3.3 School meals and milk provision

The origins of school meals can be traced to the concerns of social reformers which have been discussed earlier. As Fisher (1979) indicates, even before 1870 concerns about the health of the poor had resulted in provision of meals for children in certain parts of the country, particularly in large cities such as London.

Provision of meals in elementary schools was introduced nationally as a consequence of the report by the Committee on Medical Inspection and Feeding of Children

attending public elementary schools (1905). The committee's recommendations about the need to provide meals for 'necessitous' children were to be incorporated into the Education (Provision of Meals) Act of 1906. Under the provisions of the act Local Authorities were given powers to provide meals for:

"children attending an elementary school within their area ... unable by reason of lack of food to take advantage of the education provided for them."

(Education Act, 1906)

Meals were to be provided free or at reduced charges with financial support coming from a half-penny in the pound rate.

Prior to 1939 the provision of school meals was limited to a small proportion of children in elementary schools throughout the country, namely those in greatest need. By 1939 about half of the local authorities provided meals for pupils. By the end of the war in 1945, as Fisher (1987) indicates, the school meals service had been transformed to provide meals for the majority of children. The work of social nutritionists such as Boyd Orr (Orr, 1936) and Drummond, who had studied the health of school children, had been particularly influential in determining minimum nutritional requirements for school meals during the war. Meals were provided free to eligible children and at cost price to others. Fisher suggests that during this period school meals became particularly important in nutrition education, including social development and in the extension of food tastes. School meals, she suggests,

were established as:

"a quick, cheap and easy way of improving and protecting the health of children..."

(Fisher, 1987, p.189)

Milk was also provided in schools during the war at subsidized rates, as is detailed in Section 1.4.3; milk for the poorest children was provided free of charge. By 1945 three quarters of school children received one third of a pint of milk. Following the end of the war milk provision in schools continued until the nineteen seventies. The provisions of the Education Act of 1944 (Section 49) made Local Education Authorities (LEAs) responsible for the provision of milk and school meals for pupils at schools maintained by them. Shardlow (1977) argues that the provision of free milk to schools was the only positive success of the social nutrition reformers in their demands for a national nutrition policy during the nineteen thirties. The author considers that the provision of milk to schools, other than during the war, was also politically expedient. This view is endorsed by Leff and Leff (1959) who point out that the government's original Milk Marketing Board Scheme of 1934, which provided cheap milk for school children, was part of a policy to utilise surplus milk.

One of the outcomes of war-time rationing and the extension of school meals and school milk provision during the period 1939-1945 was the improved nutritional status of children. The generally improved physique and general health of children in the United Kingdom in 1945 was noted by an international meeting of the Nutrition Society in

London in 1946 (Fisher, 1987). The report by the Chief Medical Officer on public health from 1939 to 1945 (Ministry of Health, 1945) provided evidence from clinical surveys that children were indeed healthier than they had been prior to the outbreak of war and that mortality from disease was low.

Enshrined in the Education Act of 1944 had been the idea that school meals should be part of the school day, rather than merely an adjunct to the curriculum, and that meals should be provided for all children. The educational element of school meals was lost after teachers' action in the 1960's which resulted in teachers not supervising school meals as part of their contractual duties. Although many schools, particularly primary schools, continued to provide 'family' service, in which pupils and teachers ate together, supervision of school meals in most schools ceased to be regarded as the responsibility of teachers. Opportunities for nutrition education in its broadest sense were therefore lost.

Although the educational ideals underpinning the provision of school meals largely disappeared in the period from 1960 to 1990 the nutritional standards governing school meals continued to be controlled by the Department of Education and Science (DES) until the Education Act of 1980. As late as 1975 the Working Party on the Nutritional Aspects of School Meals (DES, 1975b) had recommended that school meals should continue to provide 880 kilocalories, one third of the Recommended Daily Intake, and 29 gms of protein. Guidelines were given also

for the provision of fresh meat and the inclusion of milk and cheese. The inclusion of milk as part of meals was stressed because, the working party pointed out, school milk was no longer being provided to the majority of older pupils in junior schools. Concern was expressed about the snacks available to pupils, particularly confectionery and drinks which could lead to dental caries.

The Education Act (1980) was particularly controversial, as is evident from press coverage at the time. The Act moved the onus of responsibility for nutritional standards for school meals to Local Education Authorities (LEAs). The social services element of school meals provision continued for children deemed to be 'in need', for example children whose parents were on low incomes; the meals provided for these children were the same as those available for other children in the school. The devolved responsibility for school meals provision was less cause for concern than the fact that LEAs were no longer required to meet nutritional standards for meals or to provide a 'set meal' for pupils. Concerns about the lack of nutritional standards and the effect of these on children, particularly those entitled to free school meals, led to pressure on the Department of Education and Science (DES) to reintroduce nutritional standards for school meals. In 1982 the report by the Education Science and Arts Committee (1982) on school meals recommended a return to nutritional standards for school meals. The recommendation was rejected by the DES with the reported comment that there was no guarantee that pupils would eat the food

prescribed! (Spencer, 1982)

One of the most significant outcomes of the 1980 Act was that LEAs decided, for both political and economic reasons, to opt for competitive tendering for schools meals. In the period after 1980, as has been indicated by the Coronary Prevention Group (CPG, 1987), problems arose as LEAs did not necessarily make their school meal caterers aware of the objectives of the service or require them to meet a common nutritional standard. The pattern of provision also changed as many schools, although not primary schools, moved to a cafeteria service. The move to different types of provision in itself is not necessarily cause for concern, but the lack of control over nutritional standards is, particularly in the context of the diets of the poor. Organisations such as the Coronary Prevention Group (CPG, 1987) continue to press for a more coherent policy for school meals provision which reflects nutritional recommendations by national committees (for example NACNE, 1983; COMA, 1984) and international organisations such as the World Health Organisation (WHO, 1990) which are discussed later in Section 1.4.

Current provision of school meals has to be viewed in the wider context of changes in eating patterns in the population as a whole and changing views regarding diet and health, which are discussed later (Section 1.4). Surveys of the diets of school children, including the national survey by the Department of Health and Social Security reported in 1986 (Wenlock et al, 1986; Department of Health, 1989), have revealed major shifts in eating

patterns amongst children. The Department of Health survey findings provided evidence that chips, buns and pastries dominated the weekday lunches of school children. Chips eaten as part of school meals accounted for fifty per cent of the daily weekday consumption amongst older pupils. These findings have implications for government as well as parents, school meals providers and educators. Whilst it has to be recognized that school meals are only one element in the diet of children the national survey findings that three quarters of children had fat intakes over the level of 35 per cent recommended by COMA (1984), point to a continued need for national nutritional standards for school meals. In the author's view it is an indictment of society and government that the concerns of social reformers about the diet of children, which were instrumental in bringing about the provision of school meals in 1906 (Education Act, 1906), remain a focus for discussion of social policy at the end of the century.

1.3.4 The emergence of the Welfare State

The emergence of the Welfare State is linked generally to the report on Social Insurance and Allied Services (1942), the so called Beveridge Report. The concepts embodied in the Beveridge Report can be traced, however, to ideas advocated by social reformers, including the Webbs and other members of the Fabian Society, the work of Booth and Rowntree and to legislation earlier in the twentieth century.

The aim of the Beveridge Report was to eliminate poverty and ill-health caused by poverty through the provision of a comprehensive system of social security. Social security was defined as the provision of a minimum income in times of hardship, for example through interruption of earnings through sickness. Beveridge, as Clarke (1949) points out, related ideas of social insurance to ideas concerning the prevention and treatment of sickness and poverty which are attributable to the social reformers. Clarke's views are substantiated by Walker and Church (1978) who draw attention to the influence of Rowntree, who was a member of the subcommittee which calculated the level of subsistence benefits which were incorporated into the Beveridge Plan.

Implicit in the philosophy of both the Minority Report and the Beveridge Report was the argument that the moral purpose of any social programme was as important as the economic and humanitarian content; reducing idleness and ignorance was as important as reducing disease and poverty. Clarke (1949) argues that the administrative framework which underpins the Welfare State, such as the National Insurance Act of 1946, addresses the substance of the recommendations of the Beveridge Report whilst ignoring the underlying philosophy. It appears that reforming legislation in general fails to address the philosophies which underpin that legislation. The author suggests that although failure to address such issues is undesirable it may not necessarily affect the outcome of the legislation, particularly if the attitudes of society at that time are

conducive to reform. As Bruce (1973) indicates, by 1945:

"the welfare of all was a matter of major concern to society as a whole." (Bruce, 1973)

A number of the provisions which were embodied in the Beveridge Report have been discussed in earlier sections, including the links between new welfare legislation and education, particularly the provisions of the Education Act of 1944. Section 1.3.2 outlined the duties which the Education Act of 1944 gave to LEAs to provide free medical and dental treatment, which was, the Court Report suggests (CCHS, 1976), the initial step in the provision of comprehensive health services for everyone as of right. The development of the provision of school meals and milk during the war, and as a basic tenet of the Education Act of 1944, was discussed in section 1.3.3. These various strands need to be seen as part of ^{the} fabric of the welfare state.

1.4 NUTRITION AND HEALTH

"...the (human) species has subsisted for most of its history on low-fat, high-fibre diets, rich in vitamin C and many other micronutrients, to which it presumably adapted biologically to achieve optimum function."
(WHO, 1990 p.40)

References to possible links between diet and health appear in very early manuscripts, including the influential Hippocratic Corpus which consists of a series of medical treatises written mainly between 430 and 330 BC. Many of the treatises discuss the role of diet as a means of promoting health and as a causative agent in disease and from them it is possible to build up a general picture of contemporary ideas concerning diet and health.

The Hippocratic treatise on Traditions in Medicine (in Lloyd (ed.), 1978) suggests that the 'modern' diet was the result of "many years' discovery" (p.72) in which people gradually selected and processed food so that it was readily digestible. The treatises indicate that a great deal was understood about the types of foods which could be eaten to maintain health. The importance of diets for particular groups, for example athletes and the aged, was recognized, as was the idea that certain foods were a cause of sickness. The diet recommended in 'A regimen for health' (in Lloyd, 1978, p.272) was one based on cereals, baked as bread or barley cake, roast or boiled meat and fish plus vegetables, both cooked and raw. What is of

particular significance is that much of the advice given could have been written today, it is very similar to guidance on healthy eating in recent publications by, for example, the World Health Organisation (1990). Even some of the suggestions which may appear contrary to current views of diet and health, for example eating fewer vegetables in winter, may be pragmatic advice based on seasonal variation in the availability of certain foods.

Waterlow's study (Waterlow, 1989) of the diets of Mediterranean region in Greek and Roman times, based upon study of contemporary writers and artefacts, provides further evidence that the diet eaten during the period when the Hippocratic treatises were written, and during the subsequent centuries of the Roman Empire, was very similar to that of people living in that region today. Waterlow identifies a basic diet consisting of cereals, fruit and vegetables and small amounts of meat or fish, which accords with the guidance provided in the Hippocratic writings (Lloyd, 1978). Waterlow (1989) has also estimated calorie intakes from records such as those of provisions supplied to soldiers, which indicates, for example that infantry men received provisions equivalent to 4,000 calories per day.

The diet which Waterlow describes for the Mediterranean region is not dissimilar to the traditional diets of much of Africa and Asia, although the staple food varies. These diets provide the nutrients which are currently recognised as being needed to maintain health in individuals. It is worth noting that diets such as these, which are similar to those advocated in current nutritional

advice from government (DoH,1991; WHO,1990), evolved without recourse to modern science. Indeed the elevation of the study of nutrition to a science is a recent phenomenon which dates from the middle of the nineteenth century in Europe. The development of our current understanding of nutrition and the impact of that knowledge and understanding on social policy in relation to diet and health forms the focus of Sections 1.4.1 to 1.4.3.

1.4.1 Nutrition as a Science

The major developments in our knowledge of nutrients in the past one hundred years are summarised in Figure 3. From this figure it can be seen that much of the work in identifying and isolating nutrients, particularly vitamins, has taken place during this century. Nutrition, as was indicated earlier, emerged as a science during the middle of the nineteenth century, although a number of discoveries concerning nutrients were made earlier. Citric acid, for example, was first isolated from lemon juice by the Swedish chemist Scheele in 1784 (Scheele, 1966).

Investigations in the early part of the nineteenth century had led to quantitative analysis of the chemical constituents of different food substances. Organic material, in particular animal tissue, was found to contain significant amounts of nitrogen. Carpenter (1986) suggests that it was as a result of these findings that ideas about the relative values of different foods arose, thus vegetables with relatively large amounts of nitrogen were

more nutritious than those with less nitrogen because they more closely approximated to the composition of animal tissues. The function of food was considered to be to enable growth to occur in young animals and to replace damaged or worn tissues in adults, a view which is in broad agreement with ideas still accepted in relation to the function of proteins in the body.

The work of the German chemist Justus von Liebig, which included studies of the function of protein in the body and energy production, was a major influence on nutritional thought for much of the nineteenth century (Liebig, 1842). The emphasis on the importance of protein in the diet, which remained a feature of policy and teaching in schools for the next century can, at least in part, be attributed to Liebig's ideas.

It was a student of von Liebig, Carl von Voit, who was responsible for developing the basis of current understanding of nutrition and metabolism during the latter half of the nineteenth century (Munro, 1964). Voit introduced the technique of what are termed 'balance studies' which Yudkin (1986) defines as the measurement of the "balance of intake and output of the nutrient" (p.257).

Voit's work on the calorific values of fats, carbohydrates and proteins enabled him to calculate the calorific requirements of adults; he also studied the food intake of the local population and calculated it in terms of these three chemicals. Voit's work was to influence advice given about food intakes for many years, as is apparent, for example, from Rowntree's recommended dietaries

(Rowntree, 1901).

Detailed knowledge about vitamins and their function in the body, as was indicated earlier, is the result of research which began at the beginning of this century and which is summarised in Figure 3. In 1906 Hopkins had argued that animals could not survive on a diet which consisted solely of proteins, carbohydrates and minerals. He also made links between diet and specific diseases, suggesting that scurvy and rickets were disorders caused by diets deficient in so far unidentified nutrients.¹

"What perhaps is absent from diets is an organic complex or complexes which the animal body cannot synthesize." (Hopkins, 1906).

Hopkins postulated that the amount of these substances required was so small that their action was catalytic or stimulative. By 1912, as Yudkin (1986) points out, Hopkins' ideas were generally accepted. It was Casimir Funk who in 1912 first designated these unknown substances "vitamines", or vital amines; the spelling was modified when later work showed that the substances were not in fact amines. Figure 3 demonstrates how detailed chemical analysis and identification of vitamins was undertaken from 1912 onwards and by 1940 the function of the major vitamins in the body was largely understood.

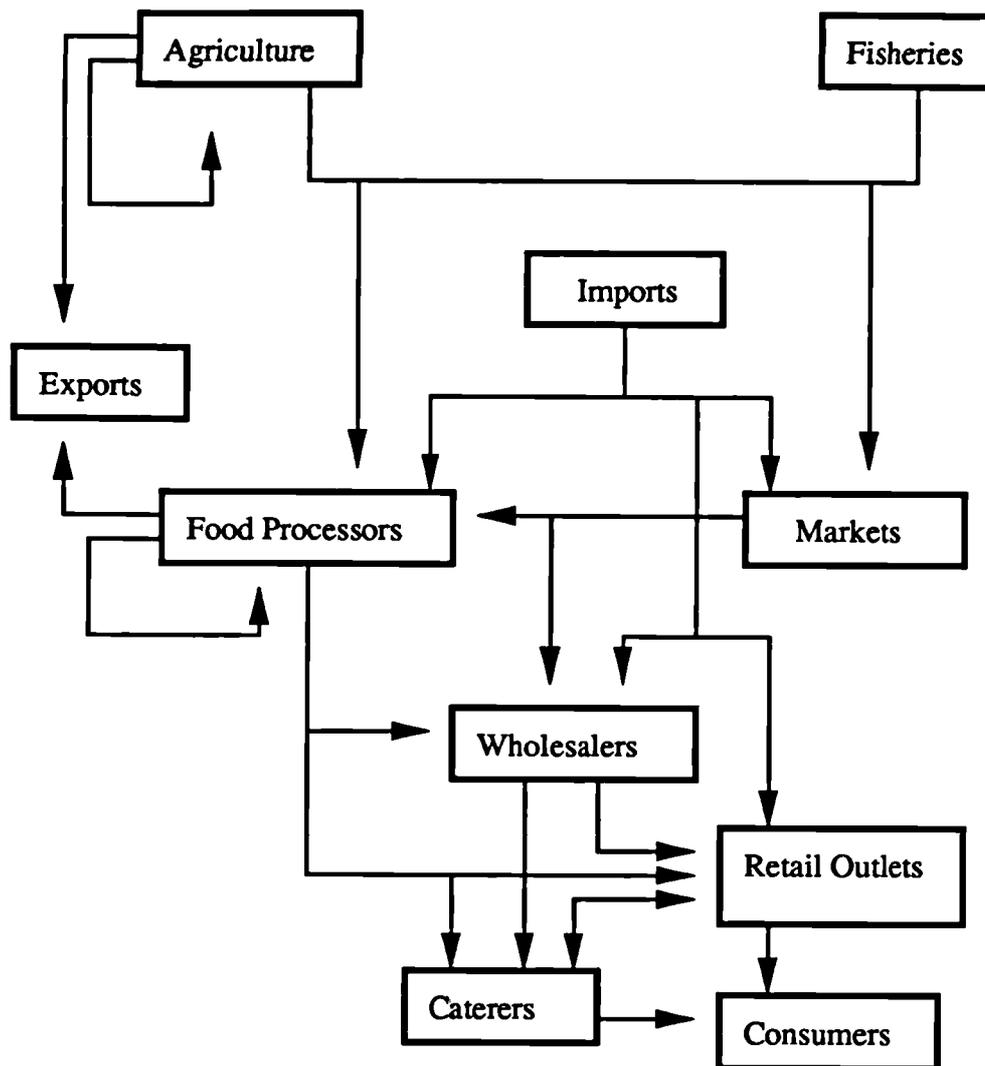
The importance of the science of nutrition during the

¹ Ships' journals and logs indicate that mariners were aware of the importance of citrus fruits as a cure for scurvy by the end of the fifteenth century. The causes of scurvy and its treatment remained a subject of debate amongst physicians and scientists until the beginning of the twentieth century. (Carpenter, 1988)

twentieth century, notably the work on vitamins and protein metabolism, cannot be underestimated. Research into the structure and importance of micronutrients in the diet continues to the present time. The function of nutritionists in areas of research other than the identification of nutrients has also been a significant factor in developing new ways of processing and preserving foods. Figure 9 summarises the varied elements in what is termed the 'Human Food Chain' (Freckleton et al, 1989). Each of the areas identified in Figure 9 has had major inputs from the scientific community. Much of the investigative work on food processing and new ways of preservation, such as irradiation and freeze drying, is the result of work by food scientists in the past five decades. There are those who have argued that these advances in science and technology have not necessarily benefitted the consumer. The Politics of Health Group (1980) point, for example, to the loss of vitamins in stored fruit and the amounts of salt and sugars used in processed foods. They argue that new types of processed foods are produced for profit motives rather than to improve the health of consumers and any health benefits are incidental.

The role of the social nutritionists in determining the way in which nutritional knowledge was applied to issues linked to social reform in the nineteen thirties (Shardlow, 1979) has already been examined in Section 1.3. The way in which increasing knowledge of nutrition affected social policy, including war time rationing, is discussed in the following sections of this chapter, as is the role

Figure 9 The Human Food Chain



Source: Based on Freckleton et al 1989

of social nutritionists in the post war period.

1.4.2 Changing views of diet and health

Information about how ideas about diet and health have changed in the period since 1870 comes from a variety of sources, for example social surveys, such as that by Booth and Rowntree at the end of the nineteenth century, and reports about the school health service or school meals provision.

The significance and importance of the research by Rowntree (1901) has been referred to earlier in Section 1.3.1. Rowntree's report on his investigation into poverty in the city of York was based on a study of approximately two thirds of the population in the city (11,560 families). The report provides considerable information concerning ideas of dietary requirements and the influence of nutritionists at the end of the nineteenth century. Rowntree, in examining what he called the "Poverty Line", considered four aspects of food in relation to the maintenance of physical health:

- i. Function of food in the body
- ii. Quantity of food required
- iii. Kind of food required
- iv. Cost of food

The importance of protein, carbohydrate, fats, salts and water as constituents in the diet were recognized; vitamins (cf Section 1.4.1) had not yet been identified. The importance of protein in the growth of children was

recognized. Energy needs were calculated on the basis of the calorific value of food which was related to protein intake in grams per day.

The food which was eaten by different social classes was also investigated by Rowntree; typical menus for working and middle class families at the time are illustrated in Figures 10, 11 and 12. The Figures reveal the lack of variety in the diets of working class families and the dependence on bread, butter and tea, together with limited consumption of fruit and vegetables, other than potatoes. Middle class diets were much more varied, and included greater amounts of vegetables, although lower middle class diets apparently contained little fruit. The lack of fruit may reflect a number of things including seasonal variation as well as the lack of awareness about vitamins, which would have lessened its perceived importance in the diet. The diets listed in Figures 10, 11 and 12 represent an average and hide considerable differences between, for example, the diets of men, women and children; working class women often went short of food in order to feed their husbands and children.

Rowntree used the findings from the surveys to make recommendations about the minimum income required by the poor. His recommendations included dietaries for adults and children, for example those shown in Figures 13 and 14. The amount and cost of the food was carefully calculated to provide what he considered a basic adequate diet. Study of the dietaries reveals once again the lack of vegetables and fruit, which has to be viewed in the light of nutritional

Figure 10

Working Class family meals at the end of the nineteenth century - based on Rowntree (1901)

Day	Breakfast	Dinner	Tea	Supper
Sunday	Bread and butter, shortcake, coffee	Pork, onions potatoes, Yorkshire pudding	Bread and butter, shortcake tea	Bread and meat
Monday	Bread, bacon, tea	Pork, potatoes, pudding, tea	Bread and butter, boiled eggs, tea	Bread and butter, bacon, tea
Tuesday	Bread, bacon, tea	Bacon and eggs, potatoes, bread, tea	Bread and butter, tea	
Wednesday	Bread, bacon, tea	Bacon and eggs, potatoes, bread, tea	Bread and butter, tea	
Thursday	Bread and butter, coffee	Bread, bacon, tea	Bread and butter, tea	
Friday	Bread and butter, tea	Toast, tea, bread and butter	Bread and butter, tea	
Saturday	Bread, bacon, coffee	Bacon, potatoes, pudding, tea	Bread and butter, shortcake tea	Tea, bread, kippers

Based on Rowntree (1901) Poverty, a study of Town Life

Figure 11

Lower Middle Class family meals at the end of the nineteenth century - based on Rowntree (1901)

Day	Breakfast	Dinner	Tea	Supper
Sunday	Tomatoes, sausages, boiled egg Bread and butter, tea	Stuffed pork, new potatoes, cauliflower Yorkshire pudding, tea	Bread and butter, teacakes, raspberry sandwich, tea	Cold meat, pickled beetroot, bread, cocoa
Monday	Bacon, bread and butter, brown bread cakes, tea	Spare-rib pie, potatoes, oats pudding, tea	Potted meat, bread and butter, teacakes, tea	Porridge, cocoa
Tuesday	Boiled eggs bread and butter, tea	Cold pork, potatoes, jam roll, sauce	Toast and butter, teacakes, tea	Porridge, bread, butter, cocoa
Wednesday	Fried bacon eggs, bread and butter, tea	Mutton, onion sauce potatoes, vegetables, pudding, tea	Bread and butter, scones, teacakes, tea	Porridge, fried fish, bread, cocoa
Thursday	Boiled eggs bread and butter, tea	Haricot mutton, lemon pudding, tea cakes	Luncheon tongue, bread and butter, tea	Porridge cocoa
Friday	Fried eggs, bacon, bread and butter, tea	Stuffed hearts, potatoes, jam pudding	Pickled mackerel, bread and butter, tea	Porridge bread and butter, cocoa
Saturday	Potted meat bread and butter, tea, teacakes	Tomatoes, sausages, potatoes, pastry, tea	Boiled eggs, bread and butter brownbread teacakes tea	Porridge fried fish, bread, cocoa

Based on Rowntree (1901) Poverty, a study of Town Life

Figure 12

Middle Class Family meals at the end of the nineteenth century

Day	Breakfast	Dinner	Tea	Supper
Sunday	Porridge, eggs, bread and butter, milk, cream coffee, tea	Mutton, cauliflower bread sauce potatoes, rhubarb, blancmange, oranges, biscuits	Potted meat sandwiches, bread and butter, cake marmalade, tea, milk	Potted meat, cornflour mould, bread and butter, cake, cheese, hot milk
Monday	Porridge, bacon and bread, toast, marmalade, treacle, tea, coffee milk, cream	Mutton, carrots, turnips, potatoes, caper sauce roly-poly pudding, rice pudding, oranges, tea	Bread and butter, teacake, milk, tea	Fish, bread and butter, biscuits, cake, oranges, cocoa
Tuesday	Porridge, bacon, eggs bread and butter, toast, marmalade, coffee, tea milk, cream	Mutton, carrots, turnips, potatoes, caper sauce Hayneck, lemon or tapioca pudding, tea	Bread and butter, marmalade, milk, cream, tea	Cutlets, stewed plums, bread, biscuits, cheese, cocoa
Wednesday	Frame food fried eggs bacon and bread, toast, butter, marmalade, coffee, tea milk, cream	Rissoles, poached eggs, potatoes, bread pudding, bread and butter, tea	Bread and butter, teacakes, milk, tea	Baked haddock, stewed plums, biscuits, hot milk

Day	Breakfast	Dinner	Tea	Supper
Thursday	Bacon and eggs, toast white and brown bread butter, marmalade, tea, coffee milk, cream	Roast mutton, greens, potatoes, chocolate mould, fruit tart, bananas, coffee, cream	Bread and butter, teacake, seed cake, marmalade, milk, tea	Fish cakes, stewed rhubarb, biscuits, bread and butter, hot milk
Friday	Porridge, fried bacon and eggs, white and brown bread and butter, marmalade, tea, coffee milk, cream	Haricot mutton, carrots, potatoes, tapioca pudding	White and brown bread and butter, cake, tea, milk	Boiled chicken, white sauce, bacon, chips, rhubarb, bread and butter, cocoa
Saturday	As Friday	Haricot mutton, cold chicken, sausages, boiled rice stewed rhubarb	Bread and butter, teacake, tea milk, cream	chicken, potatoes, bread and butter, cheese and milk

Based on Rowntree (1901) Poverty, a study of Town Life

Figure 13

Rowntree's selected dietary for children from 8 to 16 years

Day	Breakfast	Lunch	Dinner	Supper
Sunday	6 oz bread 0.5 oz margarine 0.75 pint tea	-	3 oz boiled bacon 3 oz bread 8 oz potatoes	6 oz bread 0.5 oz margarine 0.75 pint cocoa
Monday	3 oz bread 0.5 pint new milk 0.75 pint porridge 0.5 oz sugar	2 oz bread 0.5 oz butter 2 oz cake or biscuits	16 ozs potatoes with milk 2 oz bread 1.5 oz cheese	6 oz bread 0.75 pint vegetable broth 1.5 oz cheese
Tuesday	As Monday	As Monday	0.5 pint vegetable broth 3 oz bread 1.5 oz cheese 6 oz dumplings	6 oz plain cake 0.75 pint milk
Wednesday	As Monday	As Monday	As Sunday	As Tuesday
Thursday	As Monday	As Monday	0.75 pint cocoa 6 oz bread 2 oz cheese	As Monday
Friday	As Monday	As Monday	As Sunday	6 oz plain cake 0.75 pint cocoa
Saturday	As Monday	-	12 oz suet pudding	6 oz bread 0.75 pint milk

Food value of dietary = 2634 Calories per day
= 87.2 grams protein per day

Source: Based on Rowntree (1901) Poverty, a study of Town Life

Figure 14

Rowntree's selected dietary for children from 3 to 8 years

Day	Breakfast	Dinner	Supper
Sunday	5 oz bread 0.5 pint milk	1 oz boiled bacon 4 oz potatoes 0.5 pint skim milk	5 oz bread 0.5 pint new milk
Monday	2 oz bread 0.5 pint new milk 0.5 pint porridge 0.5 oz sugar	12 oz potatoes with milk 2 oz bread 0.5 oz cheese	As Sunday
Tuesday	As Monday	0.5 pint vegetable broth 3 oz bread 0.5 oz cheese 4 oz dumpling	As Sunday
Wednesday	As Monday	As Sunday	As Sunday
Thursday	As Monday	0.5 pint cocoa 4 oz bread 1 oz cheese	As Sunday
Friday	As Monday	As Sunday	As Sunday
Saturday	As Monday	1 egg 4 oz bread 0.5 oz margarine 0.5 pint cocoa	As Sunday

Food value of dietary = 1824 Calories per day
= 66.0 grams protein per day

Source: Rowntree (1901) Poverty, a study of Town Life

knowledge at that time. Rowntree's diets were actually less generous and varied than current Workhouse diets in York, as can be seen from Figure 15, although the energy value of the food was comparable. The reason for these differences lay partly in the general orders regulating workhouse diets issued by the Local Government Board, which specified, for example that, with the exception of boiled or roast meat, no two dinners should be alike in any one week. There were also economies of scale in providing for large numbers, a factor which Rowntree himself recognized.

Many of Rowntree's suggestions were incorporated into later reports and legislation, for example the Minority Report on the Poor Law which was discussed earlier. His findings confirmed those from other sources, for example the Report by the Committee on Physical Deterioration (1904) which investigated the reasons for the poor health of army recruits during the Boer War (Rowntree indicates that in 1896 42 per cent of army recruits were rejected on health grounds). War, as Ziman (1986) argues, is a potent factor in the development of scientific thinking and discovery. War is important also in changing views of diet and health in both the public and the personal domain, for example the approaches to food rationing during both World Wars, particularly from 1939 to 1945.

At the beginning of the first World War in 1914 food rationing and the control of food prices, had been advocated by the War Emergency: Workers' National Committee (Middleton, 1949). Food rationing was implemented only in 1918, but not to safeguard health or because of food

Figure 15 Workhouse diets in the city of York at the end of the nineteenth century: children from 8 to 16 years

Day	Breakfast	Dinner	Supper	Additional
Sunday	6 oz bread 0.5 oz butter 0.75pt tea or milk	2.5 oz roast beef 2 oz bread 6 oz pots.or other veg. 8oz sago pud	6oz bread 0.5 oz butter 0.75 pint tea,milk or cocoa	-
Monday	3 oz bread 0.75pt tea or milk 0.5 pint porridge 0.5oz sugar	3 oz bread 4 oz boiled mutton 8 oz pots or other veg. 0.5 pint stewed fruit	6oz bread 1.5oz jam 0.75 pint tea,milk or cocoa	2oz bread 0.5 oz butter or dripping
Tuesday	6 oz bread 0.75 pint tea or milk	2 oz bread 2 oz boiled mutton 6 oz pots or other veg. 0.5 pint rice milk	6 oz seed or plain cake 0.75 pint tea, milk or cocoa	2oz bread 0.25 oz butter or dripping
Wednesday	6 oz bread 0.75 pint tea or milk 2 oz bacon	3 oz bread 4 oz boiled beef 8 oz pots.or other veg. 0.5 pint stewed fruit	6oz bread 2oz onions or lettuce 0.75 pint tea, milk or cocoa	2 oz seed cake or biscuit
Thursday	As Tuesday	2 oz bread 2.5 oz roast beef 6 oz pots.or other veg. 8 oz rice pudding	As Monday	As Tuesday
Friday	As Tuesday	3 oz bread 8oz wet fish 8oz pots. or other veg. 0.5 gill sauce	As Tuesday	As Wednesday
Saturday	3 oz bread 0.5pt tea or milk 0.75 pint porridge 0.5oz sugar	4 oz bread 12 oz stewed meat	6oz bread 0.5 oz butter 0.75 pint tea, milk or cocoa	As Wednesday

Source: Rowntree, 1901

shortages. Taylor (1975) argues that rationing was introduced to allay public fears about scarcity rather than to reduce or to control public consumption. Ration books provided reassurance that demand for food would be met, at a moderate price. The subsidies on food items introduced at this time were the precursors of the subsidies which were to keep the price of food low later in the century. Rationing, and the associated food subsidies, continued until 1921 and served to stem post-war inflation.

Food rationing was reintroduced during the Second World War in 1940 and appeared to be planned and implemented in a more systematic way than in 1918, although Taylor (1975) suggests that this was not so. Rationing was promoted by the Ministry of Food, a ministry created as part of war time planning, as a means of distributing food more efficiently, as had been the case in 1919. The general view, Taylor (1975) suggests, was of reduced and controlled consumption. Nutritionists, including Boyd Orr and Drummond, had been involved in developing dietary guidelines which provided adequate diets for individuals of all ages. Emphasis was placed on greater consumption of cereals allied to a reduction in meat consumption. This advice was based on sound economic and health considerations but Taylor indicates that it was initially resisted by the Ministry of Agriculture, which favoured increased meat production.

Shardlow (1979) suggests that during the nineteen thirties nutrition came to be regarded by the population as associated with the quality of food. The prevailing ideas

about nutrition were related to "eating scientifically" (Shardlow, 1979); the important message that we eat food not nutrients was largely ignored. This view of nutrition was one which was promoted by the Ministry of Food throughout the war and is exemplified by promotional leaflets and posters, such as that shown in Figure 16, which were part of a careful and well orchestrated propaganda campaign on the part of the Ministry of Food. The views of diet and health which informed the nutritional messages can be related directly to knowledge about nutrition, which had advanced significantly in the period between 1914 and 1940, and to the work of the social nutritionists which was discussed in Section 1.3.1. The surveys by Boyd Orr (Orr, 1937) had indicated that at least a quarter of the population was undernourished; information published by the government in 1941 (in Minns, 1980) gave the figure as twenty per cent overall, and seventy per cent of children. By the end of the war there is evidence that the health of children had improved considerably as a result of improved diets (Fisher, 1987).

Figure 17 summarizes the amounts of basic food stuffs which were allowed for each person and which were calculated to be adequate to maintain health and energy requirements. Some foods were not rationed, for example, fish, fresh fruit and vegetables but were subject to seasonal variation. Minns (1980) outlines how preference was given to certain groups, for example pregnant women and children under five, who received a pint of milk per day and a double supply of eggs. Children between the ages of

Figure 16

How to eat wisely in wartime

42

FOR HOME & COUNTRY

ON THE KITCHEN FRONT

How to eat wisely in wartime . .



So much of our food comes from overseas, using valuable shipping space, that care and skill in its choice and preparation is now an urgent national necessity.

To eat wisely in wartime we should vary our meals as much as possible. There may be a shortage of some of the foods we usually buy but there will always be others to take their place. To keep fit and well we should choose something from each of the four groups below, every day.



THE FOUR FOOD GROUPS

(1) BODY BUILDING FOODS:

Milk, cheese, eggs, meat, fish.

(2) ENERGY FOODS:

Bacon and ham, bread, butter or margarine, cheese, dried fruit, dripping or suet or lard, honey, oatmeal, potatoes, rice or sago, sugar.

(3) PROTECTIVE FOODS

(Group 1): Milk, butter or margarine, cheese, eggs, liver, herrings or salmon (canned or fresh).

(4) PROTECTIVE FOODS

(Group 2): Potatoes, carrots, fruit (fresh or canned but not dried), green vegetables or salads, tomatoes, wholemeal bread.

ISSUED BY THE MINISTRY OF FOOD

33 D

Source: Kitchen (1990)

Figure 17

War time rationing 1940 to 1945

Amount per week per adult*	Food item	Details of ration provision
4 oz	Bacon and ham	
1lb (approx)	Meat	Amount governed by cost - up to value 1s.2d. Offal initially not rationed. Sausages not rationed but difficult to obtain.
2 oz 4 oz 2 - 4 oz	Fats - Butter Margarine Cooking fat	
2 - 8 oz	Cheese	
2 - 3 pts	Milk	Skimmed dried milk also available - 1 tin (4 pints) every 4 weeks Expectant and nursing mothers + children under 5 years 1 pint per day Children 5 to 16 half pint per day
1 - 2	Eggs	Sometimes only 1 every 2 weeks Dried eggs also available - 1 pkt (= 12 eggs) every 8 weeks
8 oz	Sugar	
	Preserves	1 lb every two months
3 - 4 oz	Sweets	
2 oz	Tea	

* Amount varied depending on availability

Sources: Minns, 1986; Patten, 1990

five and sixteen were allowed the full meat ration and half a pint of milk a day. The National Milk scheme, which was launched in 1940, guaranteed the provision of milk for certain groups and provided milk free for families in need. Milk was also provided in schools at subsidized rates; by 1944 approximately seventy-five per cent of children received a third of a pint of milk a day, this was available free for the poorest children. Provision of school meals, as was discussed in Section 1.3.3, also increased.

Throughout the war the Ministry of Food broadcast and published information about food, such as the 'Food Facts' illustrated in Figure 18, which included recipes and advice on diet and health. The effects of this propaganda exercise were widespread, not least in schools where information about healthy eating was supported by provision of milk and meals. In addition the public were urged to "dig for victory" by the Ministry of Food. One outcome of this policy was that school gardens flourished at this period in many parts of the country.

1.4.3 Nutrition and health - developing policy

During the second World War the debate between the government and the social nutritionists was suspended. Many of the ideas advocated by the social nutritionists, in particular those for improving the diet and health of the poor, were incorporated into war time food policy and into the Beveridge plan for the Welfare State. The

Figure 18

Food facts:

Information from
Ministry of Food
World War II

MINISTRY  OF FOOD

FOOD FACTS

ON THE POTATO FRONT

POTATOES are home grown : we can eat as many as we like without using one inch of cargo space. Potatoes are good for us : they give us energy and bodily warmth and are what scientists call "protective" foods — that is, they help us to ward off infections. And remember—potatoes shouldn't always mean *boiled* potatoes. There's no end to the delicious ways in which they can be served.

Can you Cook Potatoes?

Before you answer "Yes" just read quickly through these questions.

1. Do you always scrub your potatoes rather than peel them? (Nearly one-fifth of the value of the potato is lost if it's peeled.)
2. Do you conserve the goodness of your potatoes by baking or steaming them whenever possible? (If you haven't a steamer, a colander put over a pan of boiling water and covered with the pan lid will do.)
3. When boiling potatoes, do you boil them only for 10-15 minutes, then drain, cover with a cloth and the lid and then let them cook in their own steam for about 20 minutes, to keep them whole and floury?
4. Do you keep your baked potatoes nice and floury by bursting them gently when they are done, and returning them to the oven for a minute to let the steam escape?



wise, scoop out most of the inside and mix in a basin with pepper and salt and about 2 ozs. of grated cheese. Pile the mixture into the potato cases, sprinkle the tops with a little more grated cheese and return to the oven to brown.

2. Mix the scooped-out potato with about 4 ozs. of cooked meat or fish, finely chopped. Season with salt and pepper, pile into the cases, sprinkle with chopped parsley and reheat in the oven.

3. Mix the scooped-out potato with any left-over cooked vegetables and serve as above.

Potato Pastry

There's no end to the things you can make out of potato. Try this recipe some time. You'll need:—

4 ozs. sieved, cooked potatoes, $\frac{1}{2}$ teaspoonful salt, 8 ozs. plain flour, 3 ozs. cooking fat, 2 teaspoonfuls baking powder.

Sieve the flour with the baking powder and salt. Rub the fat into the flour, add the potato and rub in lightly. Mix to a very dry dough with a small quantity of cold water. Knead well with the fingers and roll out. This is delicious with either sweet or savoury dishes.

Cautionary Tale!

Those who have the will to win

Cook potatoes in their skin,

Knowing that the sight of peelings

Deeply hurts Lord Woolton's feelings

Potato Salad

The golden rule about Potato Salad is "Mix warm and eat cold."

Steam some potatoes in their skins, peel and cut them into small chunks while still warm, add a finely chopped raw onion and whatever kind of salad dressing you like best. Mix these together thoroughly with a wooden spoon. When the salad is cold, add a good sprinkling of chopped parsley.

Stuffed Baked Potatoes

Large baked potatoes can be stuffed in a great variety of ways. Here are three suggestions:

1. Cut the potato in half length-

Remember to turn on the wireless at 8.15 every morning to hear useful hints and recipes.

Source:

Kitchen (1990)

implementation of social legislation by the government, for example the school meals provisions of the Education Act of 1944, ensured that poverty and diet were less emotive public issues. Furthermore rationing continued until the early nineteen fifties and the post-war boom meant that unemployment was low and poverty therefore less widespread. By the late nineteen seventies there was, however, a resurgence of the debates concerning diet, health and poverty. Social nutritionists once again began to influence government and public opinion; they were led by individuals working for professional bodies, such as the Dietetics Association, charitable organisations, for example the Coronary Prevention Group and pressure groups which included the Politics of Health Group and the London Food Commission.

The reasons for the emerging debate can be traced to a combination of political, economic and social factors. Rising unemployment and increasing poverty, changes in social and family life, changes in social legislation and concerns about the increase in diet related diseases, all contributed to a climate of growing concern about diet and health and to growing pressure for the government to develop a national food policy. There is a further element in this debate, which is well summarized by Hollingsworth:

"advice that is necessary where and when food is abundant may appear to those not learned in nutrition to contradict advice given when food is short."

(Hollingsworth, 1983, p.291)

The paradox identified by Hollingsworth was fundamental to

much of the debate concerning diet and health in the period from 1970 onwards.

Since 1950 there has been no shortage of food in this country. New methods of processing and preservation have led to the creation and availability of a great range of new food products. Food choices are thus less simple than in the past. The direct, uncomplicated war time messages concerning diet and health, which were outlined in Section 1.4.2, have been augmented by what appears to many to be more complicated and thus confusing advice. Tudge (1985) has likened the situation to a jungle in which we need to "steer a course through abundance." The issue concerning the distinction between the food that we eat and advice based on nutrients that Shardlow (1979) identified as significant in the debate of the nineteen thirties was unresolved. The effect of these issues on nutrition education in schools will be considered later in Chapter II.

The Court Report 'Fit for the Future' (Committee on Child Health Services, 1976) indicates that improvement in health amongst children in the post war period was the result of increased national wealth and a wider distribution of that wealth. The Report identified one of health problems which needed to be addressed in the nineteen seventies as that of malnutrition resulting from overeating. Like most government reports and advice in the latter part of the twentieth century the report stressed the need for individuals to take personal responsibility for their health. It also, however, identified the

responsibilities of government, which included effective social policies and education.

The National Advisory Committee on Nutrition Education (NACNE), which was set up in 1979 under the Chairmanship of Professor J.N. Morris, can be regarded in some respects as a fulfilment of the responsibilities of government identified by the Court Report (1976), although NACNE itself was not a government committee. The task of the committee was to identify what was wrong with the diet of the population as a whole, as well as the average diet of individuals, and to consider how it could be improved. The Committee was composed of a mixture of practising nutritionists and food scientists as well as representatives of government departments and the Health Education Council. From the beginning the committee faced difficulties concerning how to define what constituted a healthy diet (Open University, 1985).

In 1983 a discussion paper was produced by NACNE (1983) which contained proposals for nutrition guidelines for health education. The proposals were based on a consensus view from earlier reports and were very similar to dietary goals produced in the United States in 1977 (US Congress, 1977) and World Health Organisation recommendations (WHO, 1982). There was nothing new in the report in relation to diet and health, indeed it did not consider recent research. The report was published, however, amidst a storm of controversy and publicity. The report was leaked to the press before it was published and the ensuing debate aroused national interest in diet and

health. The main controversy was related, the Open University (1985) asserts, to the implications of implementing the guidelines suggested by NACNE, particularly by the food industry.

The NACNE report (NACNE, 1983) reiterated what had been said by nutritionists for some years, namely that the average British diet was an unhealthy one. The report outlined both short and long term goals in relation to improvements in the average diet; the main recommendations are summarized in Figure 19. NACNE did not provide advice for individuals, although guidance was given for groups, for example the elderly, where appropriate. Long and short term goals were considered necessary as the goals had implications for all those identified in the human food chain illustrated in Figure 9 and it would take time to implement all the recommendations. As can be seen from Figure 19 NACNE advised a reduction in fat, sugar and salt consumption and an increase in the intake of dietary fibre. The guidance provided by NACNE was very specific, it identified the amounts by which intakes of, for example fat and sugar, should be changed. Most importantly NACNE provided unequivocal guidance and a basis for developing a national policy.

In 1984 the government Committee on Medical Aspects of Food (COMA) published its report on 'Diet and Cardiovascular Disease' (COMA, 1984). Although, as the Open University (1985) indicates, there had been misgivings that the Department of Health and Social Security (DHSS), under whose auspices COMA had been set up, might have been

Figure 19

Summary of NACNE dietary recommendations for adults

	Long term targets	Short term goals
Fat	30% total energy intake; saturated fatty acids 10% of total energy intake	Reduction to 34% kcal intake
Salt	Reduction	Short term reduction by 10% to 1g per day
Sugar	Reduce to 20kg per head per year	Reduction from 38 kg per year to 34 kg i.e. 12% total energy
Fibre	Increase to 30g per day from 20g per day	Increase in total dietary fibre by 25% to 25g; increased intakes to come from greater consumption whole grain cereals + fruit and vegetables
Protein	11% total energy	No changes required in intake; other recommendations mean greater proportion to come from vegetable sources
Minerals, vitamins	No specified change; should meet recommended daily allowances (DHSS)	Changes recommended in other nutrients would increase intakes
Alcohol	4% total energy	Reduction to 5% in short term from 6% total energy intake

Based on National Advisory Committee on Nutrition Education recommendations (1983)

under pressure from the Ministry of Agriculture and Food (MAFF) and the food industry, the recommendations in the COMA report bore striking similarities to those published by NACNE in the preceding year. The differences in the recommendations related mainly to the remit of the two committees; COMA was concerned only with diet and heart disease whilst NACNE was looking at all aspects of diet and health. Figure 20 compares the COMA and NACNE recommendations for fats, salt, sugar and fibre. In some respects COMA was more cautious in the way in which it presented its recommendations, for example that on salt was couched in more general terms than NACNE. The differences in the recommendations about fat intake is partly a result of the basis on which the figures were calculated; NACNE had included alcohol in calculating daily food energy whereas COMA did not.

The recommendations of the NACNE and COMA reports were to have considerable influence on all sections of the human food chain throughout the nineteen eighties, including food processors and retailers. For consumers one of the most visible signs of the changes wrought by the reports was that food labels 'Low fat', 'no added sugar' became increasingly familiar, as did 'healthy eating' pamphlets produced by leading supermarket chains. Some of the changes were the result of responses to consumer pressure allied to heightened awareness of diet and health on the part of individuals and groups. Some of these changes were undoubtedly beneficial but others were less so. Many of the 'healthy eating' messages were couched in negative

Figure 20

NACNE and COMA recommendations - how do they differ?

Target	NACNE*	COMA	Explanation of differences
Fats	Energy from fat to be cut to 30% of daily energy (10% from saturated fats)	Energy from fat to be reduced to 35% (15% from saturated fats)	NACNE includes alcohol in calculating daily energy requirements
Salt	Reduce by 3 grams per day	Decrease	COMA did not recommend amount; ways of reducing intake needed to be worked out first. NACNE recommendations only possible if high salt processed foods avoided
Sugar	Reduce by half from 30g to 20g per day; sugar should form only 7% daily energy needs	No increase	COMA recommendations relate to reduction in cardio-vascular disease
Fibre	Increase from 20 to 30 grams per day by increasing complex carbohydrate intake to form 48% total energy.	Recognizes benefits of compensating for reduced fat intake with increased fibre-rich carbohydrates	COMA recommendations relate to reduction in cardio-vascular disease; specified that affect of increase of fibre in diet not fully tested

* Long term proposals; NACNE also provided more modest short term goals for the 1980's

Source: Open University (1985) Healthy Eating

terms, for example, 'sugar is bad for you'. Messages of this type serve to increase anxiety rather than promote positive views about eating and health.

The influence of NACNE and COMA was apparent in nutrition education at all levels, including schools. The implications of the National Curriculum (DES,1987) for teaching about food and diet was discussed in Section 1.2.4. The National Curriculum Council guidance on Health Education (NCC,1990b) provides a framework for teaching about food and diet which is consistent with current views of diet and health. One of the most encouraging aspects of these guidelines is that health education in general is treated in a positive manner.

The recommendations by NACNE and COMA, although influential, did not lead to a national policy for nutrition education in the nineteen eighties, however it is possible that such reports may be used in the development of health guidelines in the future. The consultative document 'The Health of the Nation' (Secretary of State for Health, 1991) sets out the government's proposals for the development of a health strategy for England which take account of the World Health Organisation's target of "Health for all by the year 2,000". At the present time it is too early to say what the final proposals will be or what effect they will have. The consultative paper uses current COMA guidelines as a basis for its model of a healthy diet, these are listed in Figure 21. It is encouraging to note that the section on 'Eating and drinking habits' starts in a positive manner:

Figure 21

'The Health of the Nation': recommendations on diet

	Recommendations
Fats	* energy intake from all fats to be reduced to 35% or less of daily food energy intake * energy from saturated fatty acids to be reduced to 15% or less of food energy intake
Sugars	* reduce amount of non-milk extrinsic sugars * eat sugary foods less often
Salt	* reduce amount eaten
Cereals and starchy foods	* increase amounts eaten to replace sugary and fatty foods
Alcohol	* avoid excessive intake

Source: Department of Health (1991) The Health of the Nation

"Food ought to be enjoyable as well as providing the energy essential to life."

(Secretary of State for Health, 1991, Annex E)

Although the discussion in this section has focussed on aspects of diet and health in England the issues raised need to be viewed in a wider context. Both the politics of food and current concerns about diet and health transcend national boundaries. The World Health Organisation (WHO) has recently published a major report on diet and health (WHO, 1990) which sets out world-wide nutrition guidelines. The report calls for a considerable reduction in the amount of sugar and animal fats eaten. WHO recommends that fat should form only 30% of total energy (which is identical to NACNE (1983)) and that less fat should be derived from meat and milk products. Sugar consumption, that is from refined or free sugar, should also be reduced to no more than ten per cent of the calories consumed daily, the report concludes:

"they contribute no nutrients and are not essential for human health." (WHO, 1991)

The recommended diet is much like those discussed at the beginning of this section, being based on fruit and vegetables, including pulses, and cereals and cereal products such as bread and pasta. There is still much that we can learn from our ancestors!

1.5 SUMMARY

This chapter has considered three areas in relation to nutrition education in primary schools, namely education provision itself, social policy and reform and changing views regarding nutrition and health; the relationship between these areas is outlined in Figure 3. The purpose was to show how education, both in terms of its provision and the structure and delivery of the curriculum, cannot be considered in isolation. Education is inextricably linked to contemporary political, economic and social factors.

Legislation in education, particularly that relating to the education of children from five to eleven years, was used as a starting point for considering changes which have occurred in nutrition education since the introduction of universal elementary education in England under the provisions of the Education Act of 1870. The timing and form of that legislation have been related to the work of social reformers which affected both education and related social provisions. Where possible links between social and education legislation have been identified, for example that which led to the introduction of the Welfare State in the nineteen forties and which were to influence education throughout the second half of the twentieth century.

The author has argued that any study of nutrition education must include a review of the science of nutrition itself, allied to examination of changing views of nutrition and health. The previous section of this chapter (Section 1.4) provided a brief overview of the emergence of

the science of nutrition, which was related to social and economic influences.

The review in this chapter has focussed on the history of the "social machinery of schools" (Webb and Webb, 1932), the following chapter will consider other elements of the organisation of education originally identified by the Webbs which relate to the pedagogy of nutrition education.

CHAPTER II

The pedagogy of nutrition education - changing ideas about teaching and learning

2.1 Introduction

In discussing changes in education provision and the nature of the curriculum from 1870 onwards in the previous chapter the importance of changes in ideas concerning teaching and learning was acknowledged, but not fully addressed. Such ideas are fundamental to any study of education and therefore this chapter will consider aspects of educational theory and research which are of particular relevance to nutrition education.

Nutrition education, as described in the Introduction, is not confined to knowledge and understanding. The importance of attitudes in both learning and eating behaviours was stressed, as was the variety of influences which affect what Tones (1987) describes as an individual's 'nutrition career'. The concept of the nutrition career, which is illustrated in Figure 1, highlights the school as one element in a complex web of interacting influences which affect the lives and eating habits of individuals. The multiple factors which affect food choices in children, and adults, are illustrated in a slightly different way in Figure 2 which is based on ideas from the Health Education Council/Schools Council 13-18 project (1984). Figure 2 re-emphasizes the factors identified in Figure 1, such as the importance of the family and peer group pressure in

determining food choice, but it also draws attention to the psychological and moral dimensions of food choice. Some of the factors shown in Figures 1 and 2, including food availability and welfare provision, have been considered already in Chapter I. The importance of attitudes in determining food preferences and eating patterns merits more detailed discussion.

This chapter begins by a selective review of educational theories, focusing on those which have been particularly influential in the development of science and health education in primary schools, for example the work of Piaget, and which are relevant to the study described in Part II. Subsequent sections review more recent studies which have identified the importance of children's ideas and attitudes in determining learning outcomes and behaviour, particularly in relation to food and nutrition.

The close links between health education and nutrition education were discussed in Chapter I. It is therefore appropriate that aspects of teaching and learning in health education should be considered in this chapter. Also, as Wellman and Johnson (1982) suggest, children's conceptions about food and nutrition are closely linked to their developing understanding of health and illness. They argue that "nutrition is an important determinant of illness" and that the study of children's understanding of nutrition concepts is therefore of particular relevance to research on children's health beliefs, which includes knowledge about illness and the organs of the body. This emphasis on the links between health and nutrition education provides a

further reason for the consideration of aspects of health education in section 2.3.

Much of the research which has investigated children's ideas in science, including that which has focussed on aspects of food and nutrition which is considered in sections 2.4 and 2.5, focuses on classroom situations and interactions. Many of those who have engaged in such research have considered their findings in relation to teaching and learning. Section 2.6 therefore considers the implications for teaching of recent research on children's ideas and provides the background for the study of teaching and learning about food which follows in Part II.

The relevance of teachers' knowledge about science to the present study was introduced in Chapter I. A number of authors, including Bennett (1988), have identified the importance of teachers' own understanding, both in teaching and in determining and recognizing the ideas which children hold, an issue which Bennett notes was highlighted fifty years ago by Dewey. The final part of this chapter, Section 2.7, therefore considers research into the ideas which primary teachers may hold about food and nutrition.

2.2 Learning theories and pedagogy

When placed in an historical context, views about how children learn can be observed to have moved away from notions of the learner as a passive recipient of knowledge to ideas of the learner as an active participant in the learning process. Such changes were commented on in the previous chapter in the context of curriculum development and the move towards more child centred education which has characterized primary education in the past seventy years. These changes, as Gordon and Lawton (1985) point out, were influenced by the ideas of, amongst others, Froebel, Montessori and Dewey. Dewey, as Gordon and Lawton indicate, postulated that children develop according to a natural pattern and that education should follow this pattern. Dewey considered the acquisition of knowledge to be essentially a social process and a means of personal development; knowledge was therefore conceived as experience rather than as a body of knowledge which was taught or learnt.

The changes noted above are reflected in three major 'traditions' of pedagogy which are of particular relevance to nutrition education as part of science and health education in primary schools. The first of these traditions is what can be described as a 'transmission model' in which children are passive recipients of knowledge. The second is the 'discovery/process' model, in which children engage actively in purposive activities designed to develop skills. In the third, the

'constructivist' model, children are active participants in the learning process. The differences between these three models of pedagogy have been summarized clearly by Driver (1991) as shown in Figure 22, which draws attention to the relationship between pupils and learning and teaching. The figure also indicates changes in the view of scientific knowledge as objective and value free to one in which science is regarded as problematic, socially constructed and subject to change. The three models identified here can be seen as part of a 'time-line' in which the constructivist model has become increasingly important and influential in research in science education in the past twenty years.

The transmission model of education will be considered in the next section in relation to approaches to health education. The model is associated with didactic modes of teaching which form part of a continuum of teaching styles in primary schools identified by Bennett (1976). In this model children are left with little to contribute, indeed they are regarded as having little to contribute.

The discovery/process model of teaching and learning has a long tradition in primary education. The Hadow Reports (Board of Education, 1931;1933) and the Plowden Report (DES, 1967) endorsed methods based on discovery and practical experience. "Discovery methods" have come to be equated with practical experience, however the two terms are not synonymous. Much of the debate about discovery methods has hinged on the teaching approaches used, which can be seen as a continuum, namely:

Figure 22

Teaching and learning science; comparison of pedagogies

	Transmission	Process/ Discovery	Constructivist
Pupils	*passive	* active * purposive * cognitive	* active * purposive * cognitive * adaptive
Learning	* absorbing information * individual process	* abstractor of patterns	* constructing meaning * social process
Teaching	*transmission	* provides experiences	* provides experiences
Curriculum	* that to be taught	* programme of activities to develop skills	* programme of activities from which meanings are constructed
Scientific knowledge	* objective * non- problematic * fixed	* objective * non- problematic	* constructed * problematic * provisional * changing

Source: Based on Driver (1991)

- i) 'pure' discovery where children complete learning tasks without intervention by the teacher;
- ii) 'guided' discovery where the teacher structures the learning situation but provides opportunities for children to engage in problem-solving activities on their own;
- iii) teacher directed learning activities.

Ausubel (1968) suggests that there is no evidence to support the claims that 'pure' discovery on its own is a powerful motivator for learning or for improving learning outcomes. Rather there is support for guided discovery. Bruner (1966) argues that exploration should have direction and that the task should be defined in some way, with clear goals specified. Bruner does not consider that children need to "discover all generalizations for themselves" (Bruner, 1966).

A central issue in the debate about the discovery model is the need to determine whether the purpose of discovery is for children to learn something by discovering for themselves or to learn how to discover, or possibly both. Bruner (1960;1966) argues that children can learn discovery techniques and that an important element in learning by discovery is practice in the 'heuristics of discovery'; he views discovery teaching as a means of helping students to realize and to build on what they already know.

The discovery/process model is one which has long had its adherents in science teaching. The heuristic method in

science was advocated originally by Armstrong who suggested that:

"The beginner not only may but must be put absolutely in the position of an original discoverer."

(Armstrong cited in Jenkins, 1979, p.44)

Armstrong himself, as Jenkins (1979) points out, did not consider that pupils should be expected to discover everything for themselves. Heurism as envisaged by Armstrong, although influential at the beginning of the century, was overtaken by changing views of learning in science which considered that the model of science implicit in heurism was inadequate. The continued influence of Armstrong's ideas can be seen, however, in science education even today, for example in the emphasis on practical experimental teaching and, as Jenkins points out, a belief in the importance of learning "by doing". This belief has been supported by the research of Piaget (Piaget and Inhelder, 1969) and Bruner (1966) which indicates that children learn more effectively from concrete situations. 'Science 5-13' (Ennever and Harlen, 1972), which is based on the application of Piaget's ideas, provides an example of curriculum materials which use guided discovery methods of the type identified earlier.

The origins of the constructivist model can be traced to the work of Piaget. Piaget's work spanned a long period from the nineteen twenties to the nineteen sixties and his ideas have been influential in many areas of education, including those identified above. Piaget's influence on the work of prominent psychologists can be seen, for

example, in the way in which Ausubel (1968) and Bruner (1960) used his stages of cognitive development as a basis for developing their own theories of learning. Piaget's influence is evident also in research on children's understanding of food concepts, for example the work of Contento (1981) which is discussed in Section 2.5.

Piaget sought to establish what ideas children hold about the workings of the natural world by means of observations of learners themselves. As an epistemologist, rather than a psychologist, Piaget was concerned with the nature of knowledge that children exhibit at each stage of their development. Piaget (Piaget and Inhelder, 1969) outlines successive periods, or stages, in the mental development of children, each of which is characterized by an overall structure. Each stage of development, he suggests, builds on and extends the preceding period and ultimately reconstructs it; there is no disjunction between these stages rather there are transitional periods during which ideas are reformulated. Although the order in which children progress through these stages is constant the ages at which they move from one stage to the next varies, something which Piaget himself stresses. During the period from 5 to 11 years children move from what Piaget terms the preoperational or representative stage to concrete operational thought. Children from five to seven years are in a period of transition; during this stage children's thinking is based on actions performed, or related to objects they have had experience of, and is centred on themselves. The second stage, that of concrete operations

of thought and personal relations, begins at around the age of seven or eight years and lasts until eleven or twelve years. Children can manipulate ideas mentally provided that they are based on actual experiences, with things that exist, but they are not yet capable of abstract reasoning.

Piaget considers that mental development is determined by a number of factors, all of which are necessary for development to occur; these include organic growth and social interaction and transmission. He stresses in particular the importance of physical and logico-mathematical experience; knowledge is derived from constructive action and experience. He emphasizes also the importance of the learner being actively involved in the learning and teaching process.

As Driver (1989) indicates, much research in science education since the early 1970's has focussed on the conceptual models of students in specific domains. This research is derived from the work of Piaget in that it views learners as active participants in their own learning through a process of equilibration between existing knowledge and new experiences. There are, however, significant differences between the research by Piaget and the studies by those frequently identified as 'constructivists' amongst science educators. Driver draws attention to the difference in the focus of the research, which is concerned with the development of knowledge structures related to specific domains rather than with the development of non-specific logical capabilities. The second difference is one of emphasis and breadth. As was

noted earlier Piaget was concerned with the individual's development of constructs based on their interaction with the physical environment. The research in science education, whilst acknowledging the importance of such interactions, recognizes the significance of social processes in knowledge construction, both at an individual level and as part of what Driver terms the community of scientists.

The increasing recognition of the importance of social processes in learning in science has led to greater awareness amongst science educators of the importance of language and communication as an intrinsic element of knowledge construction. Driver (1989) points to the increasing influence of Vygotsky in this respect. The author suggests that science educators have perhaps been slow in recognizing the importance of the work of psychologists, such as Vygotsky, for learning in science. Vygotsky argued that speech:

" does not merely accompany the child's activity; it serves mental orientation, conscious understanding; it helps in overcoming difficulties ..."

(Vygotsky (1962) quoted in Barnes (1976) p.101)

This view is supported by both Ausubel (1968) and Bruner (1966) who stress the importance of language in cognitive development. Bruner views language as a means by which learners can 'bring order' to their environment, a view endorsed by Barnes (1976).

Both Vygotsky and Bruner, as Barnes indicates, consider language to be a means both of participating in

the life of the community to which we belong and as:

"a means by which we can actively reinterpret the world about us, including that life itself. Through language we both receive a meaningful world from others, and at the same time make meanings by re-interpreting that world to our own ends."

(Barnes (1976) p.101)

Barnes suggests that this process of re-interpreting the world results in 'action knowledge', which enables individuals to use knowledge in a meaningful way in their own lives.

The constructivist model, including consideration of the importance of social constructs and language in learning, is one which will be returned to in later sections of this chapter. The model is one which the author deems to have particular importance in the context of learning about food and nutrition.

2.3 Approaches to Health Education

The view of health education as simply a mechanism for transmitting information about aspects of health and health behaviour is an outdated one. The discussion of health education in the primary school curriculum in Chapter I showed how the emphasis on teaching in this area had changed from the transmission model towards more child-centred methods which would help children to understand the underlying reasons for their health behaviour, for example in making food choices, whilst providing them with the

knowledge to make informed decisions. These changes reflected those which were taking place in other areas of the curriculum which were discussed earlier.

One of the major changes in approaches to health education which has occurred in the past two decades is the emphasis on the development of personal and social skills, including decision making skills. How such skills can be developed and utilized is more problematic, particularly in terms of people's eating patterns. Research in this area serves to emphasize the difficulties rather than to provide solutions. There is widespread agreement based on research findings, for example studies on knowledge of nutrition by Hochbaum (1979), Davies et al (1982) and Lucas (1987), that knowledge alone is not sufficient to ensure that individuals make decisions which will promote health. This view is acknowledged in DES publications concerning health education which have been published in the past decade, including the most recent (NCC, 1990b);

"It is widely recognised that the provision and acquisition of information alone is unlikely to promote healthy, or discourage unhealthy, behaviour."

(NCC, 1990b, p.7)

Davies et al (1982) describe health education based on the transmission of knowledge as the 'conventional wisdom' model in which knowledge is seen as a means of developing acceptable health behaviour. Davies et al (1982) suggest that this view is exemplified by the 'medical model', which can be summarised as:

Information->Knowledge->Attitudes->Behaviour->Better health

Davies et al point to the shortcomings of this model, which ignores the importance both of motivation in the learning process and of the value systems of individuals. They suggest that motivation and attitudes may be more important factors in determining health behaviour than knowledge. This view is supported by Tones (1981) who suggests also that simply supplying knowledge seems to have little to do with living healthily.

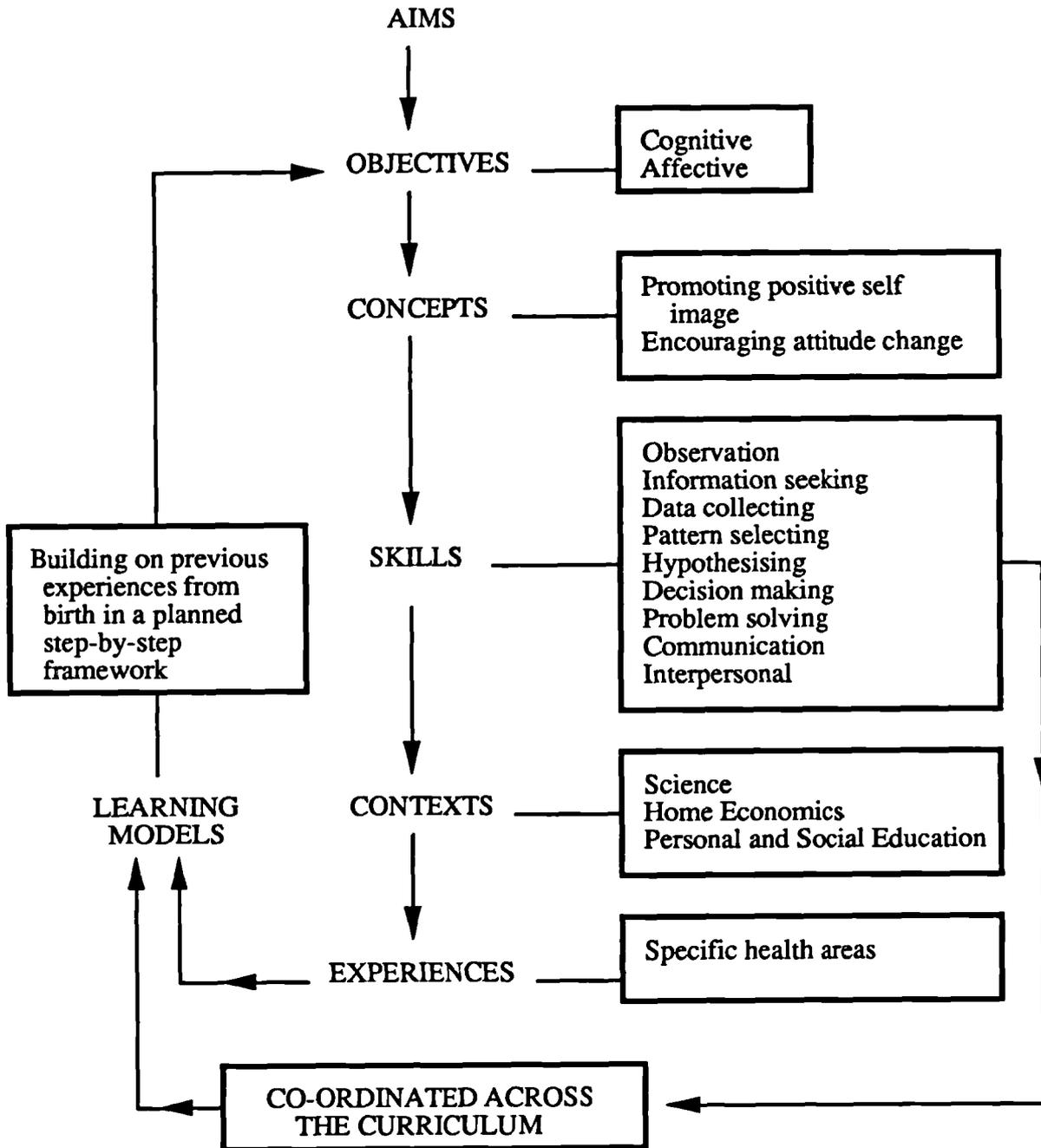
Tones (1987) outlines three further alternative models in relation to health education, none of which are mutually exclusive or antagonistic. The first of these he characterizes as the 'educational' model which is based on the premise that education is concerned with free choice and the development of rationality. The primary goal of health education is viewed as the development of decision making skills which enable informed choices to be made related to health behaviour. This model is one which has had a strong influence on health education curriculum projects, for example the influential Schools Council Health Education 5-13 project (Schools Council, 1977). As Tones indicates developing decision making skills is an ideal which is difficult to achieve in practice. Furthermore choice is rarely 'free', it is constrained by a number of factors including societal norms.

The second 'radical' model outlined by Tones focuses on critical consciousness raising in which individuals are first alerted to the social origins of ill health and then persuaded to take action. Although this model has implications for health education it is dependent on

individuals recognizing both that they can influence decisions made on their behalf and that they have the skills and knowledge to do so. Such awareness is fundamental to the third model identified by Tones, the 'self-empowerment' model. This model, which builds on the educational model, seeks to promote what Tones describes as genuinely informed decision making. It is premised on the provision of knowledge and skills, including social skills, but it seeks also to enhance and to develop self-esteem. Self-esteem and the recognition that individuals have control over their life styles, which Tones defines as the "internal locus of control" (Tones, 1989, p.13), are vital elements in the self-empowerment model. Figure 23, which illustrates how such a model might be translated into practice, is based on a framework for health education proposed by the Secondary Science Curriculum Review (West and Bentley, 1984), and provides a useful starting point for considering current approaches to health education.

The view of health education promoted by the National Curriculum Council (1990b) and the Initial Teacher Education Project (Health Education Authority, 1990) is premised on the self-empowerment model of health education outlined above. The ITE project builds on the work of the earlier curriculum development projects in health education, for example 'My Body' (HEC, 1983). The project began its work in 1982 with three separate surveys to establish what was happening in health education in primary and secondary schools and teacher education establishments:

Figure 23 Model for Health Education



Source: Based on Secondary Science Curriculum Review (1984)

- * Questionnaire survey based on 12.5% random sample of primary and secondary schools in England and Wales;
- * Questionnaire and interview survey of all teacher education institutions in England, Wales and Northern Ireland allied to visits to just over 33% of the institutions;
- * 16% stratified sample of students in initial teacher education to discover their attitudes to health education as part of pre-service courses.

The surveys reported by Williams and Roberts (1985) revealed that in the majority of primary and secondary schools health education featured as part of the curriculum, a finding which substantiated the earlier surveys by Willcox and Gillies (1981; 1983) in Sheffield which were discussed in Chapter I. Williams and Roberts found that some aspects of the work being undertaken in schools, including planning and coordination, were poor. These findings are not surprising in view of the HMI survey (DES, 1978), discussed earlier, which highlighted the low priority given to health education in the majority of primary schools and the small number of schools with posts of responsibility for health education.

During the second phase of the project the team surveyed the provision of resources for health education in teacher education institutions throughout the country and organised regional writing workshops to develop new resource materials specifically designed for use in teacher education programmes. The involvement of practitioners in

writing workshops was a characteristic of the work of a number of projects during the nineteen eighties, for example the Secondary Science Curriculum Review (SSCR, 1985). The earlier surveys and interviews with tutors had highlighted the importance of ensuring that the resource materials produced could be used flexibly in differing situations. There was support for materials which would promote discussion and allow scope for a variety of teaching and learning methods.

The materials produced by the Initial Teacher Education Project are a major resource for teacher education at both pre- and in-service level. They include materials for teaching and consideration of the theoretical framework on which the materials were developed. The model of health education promoted is one which is based on the concept of the health promoting school. This model recognizes that education in school is only one of the elements which contribute to the physical, emotional and social health of the individual. One responsibility of the health promoting school is that it should make links between the various constituents which make up the health career of the individual, for example parents and the wider community.

Health education in schools is viewed by Williams et al (1990) as a cumulative process composed of four interlinked areas:

1. The growth and development perspective;
2. The notion of the health career;
3. Finding out what pupils already know;

4. Developing a suitable spiral framework.

These four areas are underpinned by ideas of cognitive development and models of teaching and learning which were discussed in the previous section. Growth and development is considered in relation to both the physical and emotional characteristics of children at different ages, as well as the 'health' concerns of children at each of these ages.

The third area, that of establishing what pupils already know, appears to fulfil many of the features of the constructivist model identified in Section 2.2. The project identifies the need to find out where children are in terms of their knowledge, skills and behaviour without specifying in detail how this might be done or how such information might be used in negotiating a learning programme. The ITE programme is designed as a participatory one and therefore issues such as these should emerge during courses with teachers. There is no apparent recognition of the studies of children's ideas which will be discussed in later sections of this chapter although the project acknowledges the findings of the study by the Health Education in Primary Schools Project of children's ideas about health issues (Williams et al, 1989).

The last area, which relates to the development of a school programme for health education, is premised on the concept of the spiral curriculum which was identified earlier. The curriculum framework suggested for health education is similar to those developed in earlier projects (for example SCHEP, 1983) being based upon the individual,

relationships and the community and environment. Work with children is envisaged as being participatory with children learning from each other and with the teacher acting as a facilitator. The health education programme is considered as a means of increasing children's knowledge and, equally important, as a means of providing children with opportunities to make decisions and solve problems based on factual information, for example making decisions about their diet. This emphasis on decision making skills is one which, as the NCC (1990b) indicates, has been a common feature of health education programmes developed in the past decade. A more controversial area, although one fundamental to the self-empowerment model of health education, is the use of value clarification exercises to help children to explore:

"values and attitudes that promote personal responsibility and that develop positive health behaviours." (Williams et al, 1990, p.22)

Implicit in a value clarification approach, as Tones (1981) points out, is the need for the teacher to adopt a neutral stance which neither promotes a particular set of values nor attempts to change attitudes.

The suggestions for the curriculum for primary schools in the ITE project are based on those in the HEA Primary School Project (1989) which includes the following topics in relation to food and diet:

Age 7 What do I eat and how do I choose?

Age 9 What do I need to have to keep myself healthy?

Who keeps food clean?

Age 11 What makes a healthy lifestyle - diet?

- exercise?

There are evident similarities between this broad framework and the programmes of study for science (DES, 1989) illustrated in Figure 6 and the suggestions from the NCC (1990b) about health education listed in Figure 8, as well as earlier proposals on health education from the DES (1986). All emphasize the importance of food choice, with pupils being able to:

"choose a healthy diet ... and explain their reasons for doing so. This involves listening to differing views and putting one's own view; weighing evidence and reaching a conclusion." (DES, 1986, p.8)

The similarities between the HEA primary project materials (HEA, 1989) and the proposals from the NCC are not limited to content areas or skills. The NCC draws attention to the importance of relationships, such as those between staff and pupils or between the community and the school, and the school environment itself. This view of health education is closely related to and dependent for its success upon what the NCC, in considering the whole curriculum (NCC, 1990a), refers to as the spirit and ethos of the school, in essence the health promoting school which was discussed earlier.

A further development in schools during the past decade has been the emergence of Personal and Social Education (PSE) as part of the curriculum. This development is one which parallels and complements that of health education. Both PSE and health education are

curricular themes in the National Curriculum in England and Wales (NCC, 1990a). Furthermore, aspects of health education are frequently addressed as part of PSE courses in schools. PSE, as envisaged by the DES (1989), places emphasis on pupils taking responsibility for their own learning and on teaching approaches which develop mutual respect and understanding and allow pupils to work collaboratively, learning from each other. There is stress on personal qualities and attitudes, including consideration for others and respect for the ideas and opinions of others. A clear message that emerges is the importance of a positive self image.

All of the approaches to health education discussed here encompass knowledge and understanding as well as attitudes and skills which relate to nutrition education. Although the research in this area, which is discussed in following sections, has generally focussed on the knowledge which children have about food, and in some instances their behaviour, there have also been studies which have sought to influence behaviour. An example of this type of study is that by Birch, Zimmerman and Hind (1980) in the U.S.A., which investigated the snack-food preferences of pre-school children. In this study one group of children were given rewards of 'healthy' snack food items, for example peanuts, for acceptable behaviour in the classroom. The findings of the study indicated that food preference was influenced by the social-affective contexts in which foods were presented; presenting particular food items as a reward enhanced the preference for that item for at least six

weeks after the cessation of the study. Whilst the results are interesting, modification of children's behaviour in this way cannot be justified on educational grounds. Behaviour modification should arise as a result of increasing understanding of the need for change, with individuals taking responsibility for their own behaviour. The study by Birch et al does have importance, however, in the context of the way in which sweets are used as rewards, treats or gifts in families and societies. Further evidence of the influence of social interactions in the choice of food comes from the study by Newsome (1983) which is discussed in Section 2.5.

Throughout this section it has been emphasised that knowledge on its own has little influence on an individual's dietary habits. Hochbaum (1981) points out that research on food knowledge and eating patterns has provided few guidelines to help nutrition educators to develop education strategies and programmes which will help young people to make what Hollingsworth (1985) termed "wise choices" about the food they eat. One reason may be the oft quoted aphorism that we eat food, not nutrients. Further reasons can be found in the multiplicity of factors governing food choice, which are illustrated in Figure 2 and which were discussed earlier, which encompass both cognitive and affective domains. Knowledge is only one element in a complex web of social and emotional interactions which influence behaviour. Perhaps nutrition education in schools also needs to draw more effectively on what is known about cognitive development and the evidence

concerning children's ideas about food and health which is considered in the following sections of this chapter.

2.4 Children's learning in science

One of the major features of research in science education in the past decade has been the rapid growth in research into children's conceptions. The research has sought to discover what ideas children hold about scientific concepts and how these understandings impinge on their learning in science. The range of the concepts investigated is broad, particularly in the area of physical phenomena where concepts such as force, energy and light have been studied in detail. Little of this research, as Figure 24 illustrates, is concerned specifically with human food and nutrition although related areas, such as plant nutrition, have been studied in more detail.

The research into what has been characterized as "children's science" by Gilbert, Osborne and Fensham (1982) owes its origins to the work of Piaget (for example Piaget 1926; Piaget and Inhelder, 1969; Piaget and Garcia, 1987) as outlined earlier. Researchers have used interpretative techniques, including interviews which focus on natural phenomena like the evaporation of water, which are similar in some respects to those used by Piaget. Such interviews are designed to find out more about the ideas which children hold. Gilbert, Osborne and Fensham (1982) identify two types of interview, the "Interview-about-Instances" approach and the "Interview-about-Events" approach.

Figure 24

Examples of research which has explored children's ideas with particular reference to areas relating to nutrition education.

Specific topics*	Authors
Animal and animal nutrition	Bell, 1981a; Bell and Barker, 1982; Griffiths and Grant, 1985; Smith and Anderson, 1986.
Energy - including energy and health	Stead, 1981; Simpson and Arnold, 1982; Watts, 1983; Duit, 1983; Solomon, 1983; Bell and Brook, 1984; Bell, 1985; Gayford, 1986; CLIS, 1987; Gosden, 1987; Brinkman and Boschhuizen, 1989.
Food and nutrition (human)	Contento, 1981; Michela and Contento, 1981; Holland, 1981; Davies et al, 1982; Wellman and Johnson, 1982; Newsome, 1983; Barker, 1985; Magarey et al, 1986; Resnicow and Reinhardt, 1991.
Human body - including digestion	Gellert, 1962; Wellman and Johnson, 1982; Simpson and Arnold, 1982; Simpson, 1984; Carey, 1985.
Living	Stead, 1980; Angus, 1981; Tamir, Gal-Choppin and Nussimovitz, 1981; Brumby, 1982.
Plants and plant nutrition	Arnold and Simpson, 1980; Bell, 1981b; Simpson and Arnold, 1982; Roth, Smith and Anderson, 1983; Wandersee, 1983; Bell and Brook, 1984; Barker, 1985; Bell, 1985; Bell, Barron and Stephenson, 1985; Eisen and Stavy, 1987; Stavy, Eisen and Yaakobi, 1987; Haslem and Tregaust, 1987; Eisen and Stavy, 1988; Barker and Carr, 1989; Boschhuizen, 1990; Eisen, Stavy and Barak-Regev, 1989.
General reviews	Driver and Erickson, 1983; Gilbert and Watts, 1983; Driver, Guesne and Tiberghien, 1985; Carey, 1985; Bell, Watts and Ellington, 1985; Osborne and Freyberg 1985; Leeds National Curriculum Science Support Project (1991 - in press).

* Specific topics are listed in alphabetical order

Interview-about-Instances explores children's meanings of words, for example 'animal' (Bell, 1981); frequently cards with familiar situations are used to probe children's understanding. The interview situation is flexible and designed in such a way that children can ask questions and clarify their thinking. The Interview-about-Events approach described by Osborne (1980) focusses on a scientific concept, for example 'physical change' (Cosgrove and Osborne, 1981). In this type of interview the 'events' consist of practical demonstrations in which the concept may be applied.

The research into children's science has branched into discrete strands, all of which have implications for teaching science. The first of these strands, which could be termed an 'applications' strand, has considered the implications of the findings for teaching and has from the outset involved practitioners; the work of the Learning in Science Project (LISP) at the Science Education Research Unit (SERU) in New Zealand (Osborne and Freyberg, 1985) and the Children's Learning in Science Project (CLISP) at the University of Leeds (CLISP, 1987, for example) provide examples of this strand. A second strand is what can be called the "common-sense" view of science proposed, for example, by Mariani and Ogborn (1990) which seeks to develop an ontology of the common-sense reasoning of students.

There is now a widely accepted view that the ideas which children already have affect learning outcomes in science. Although the areas of science investigated are

diverse, the findings from the studies of children's ideas in science are in broad agreement and can be summarized as follows:

1. Children have ideas about scientific concepts which are based on their own experience;
2. These ideas are developed as a result of 'common sense' reasoning and provide a coherent understanding of the world;
3. The ideas which children hold may be at variance with the ideas of scientists;
4. Children's ideas are stable, strongly held and resistant to change.

The research indicates also that there are patterns in the ideas that children hold. Gilbert, Osborne and Fensham (1982) identify five patterns which relate to the way in which children make sense of the world around them:

1. Everyday language:

Words commonly used may have different meanings in science, interpretations by students based upon everyday language may therefore cause confusion;

2. Self-centred and human-centred viewpoints:

Children interpret and consider ideas in terms of their own experience, these interpretations are reinforced by the use of everyday language;

3. Nonobservables do not exist:

Despite formal teaching some learners consider that a physical quantity is not present unless the quantity or the effects of the quantity are

observable;

4. Objects are endowed with the characteristics of humans and animals:

Children often endow objects with human feelings, will or purpose; this reflects views of living things which are broader than those used by biologists and is linked to the use of metaphor in everyday language and in science teaching;

5. Objects are endowed with physical quantity.

The value and importance of identifying these patterns, both in planning lessons and in implementing such plans in the classroom is becoming more widely recognised and will be discussed in section 2.6.

The patterns identified above are evident in the studies of children's ideas which are relevant to food and nutrition summarized in Figure 24. The topic headings used in this figure provide a useful framework for considering this research although the studies frequently impinge on more than one area. Few of these studies are concerned directly with nutrients or food choice. However, many of the topics in the studies are relevant to nutrition education, for example, children's understanding of animals and plants or their ideas about photosynthesis. The research studies which focus specifically on human food and nutrition will be considered separately in section 2.5.

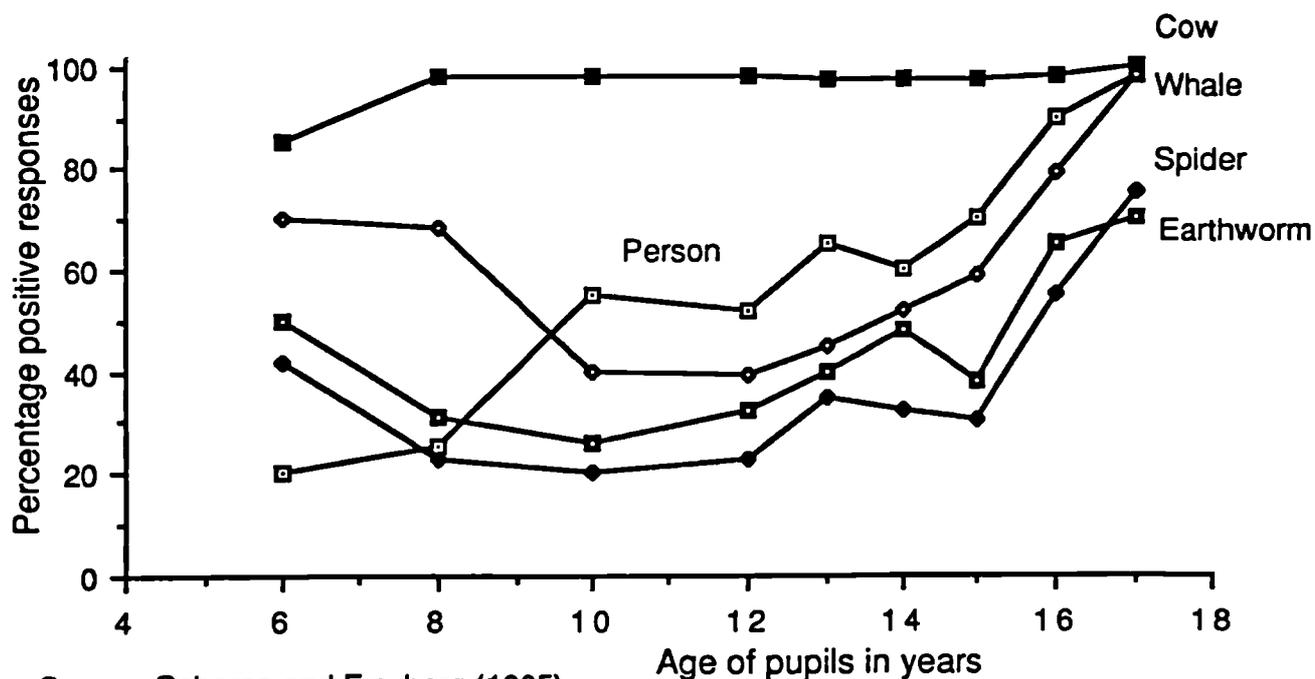
2.4.1 Ideas about animals and plants

Many of the studies of children's ideas in science have focussed on the use of language and the ways in which everyday and scientific language differs. The studies by Bell (1981a) and Bell and Barker (1982) into children's meanings of the word animal used the interview-about-instances approach identified earlier to explore children's understanding of the word animal. Pictures, which included humans and other mammals, birds and invertebrates, were used to elicit children's ideas about which pictures represented animals. The representative responses to this question which are illustrated in Figure 25 raise many questions; it is evident that a significant number of pupils below the age of sixteen do not categorize humans or invertebrates as animals, indeed the only animals consistently recognized as being animals are the large land living mammals. Bell and Freyberg (1985) suggest that the U-shape of the curves shown in Figure 25 for animals such as spiders and earthworms may be related to the ways in which animals are classified in schools; pupils are taught to place such animals in separate groups or sets but do not appreciate that spiders and earthworms are themselves subsets of the animal kingdom. Bell and Freyberg draw attention also to the fourteen per cent of experienced primary teachers in one of their studies who did not consider worms and spiders to be animals.

Figure 25 indicates also that many younger children do not regard humans as being animals. In excluding humans

Figure 25

'Is it an animal?' Representative sample response



Source: Osborne and Freyberg (1985)

from their definition of animal it appears, as Carey (1985) suggests, that young children have not mapped the word 'animal' onto the biological concept of the term. Bell and Freyberg suggest that the everyday use of the word animal, where the word is frequently used in contrast to 'people', is a cause of confusion, for example signs such as "No animals allowed".

Carey (1985) argues that although children's concept of animal may be different from that of scientists even children as young as three years have notions of the distinction between animals, as a class, and non-animals. Carey's studies of children's ideas indicated that children only attributed animal properties, such as eating, to animals and not to inanimate objects. However many younger children, below the age of ten years, do not recognize that all animals eat.

Bell's (1981b) study of children's ideas about plants showed that their understanding of what constituted a plant differed from that of biologists. The sample in this study was a small one, namely twenty nine pupils aged 10, 13 and 15 years, however the results are consistent with later work undertaken by LISP which is reported by Osborne and Freyberg (1985). Almost half the sample whom Bell interviewed considered that carrots and cabbages were not plants; they were vegetables. Over half the pupils regarded seeds as not being plant material. There was a marked similarity in the ideas held by pupils in all three age groups, however older pupils were more likely to identify carrots as plants.

These studies of children's ideas about animals and plants have evident relevance to teaching and learning about food, particularly teaching which involves language which may be at variance with that used by pupils in everyday life. Such studies have implications also in the classification of food items for purposes of food choice and dietary guidelines.

2.4.2 Animal nutrition

The study by Bell and Barker (1982) of thirteen year old pupils' ideas of producers and consumers indicates how the mismatch between children's and scientists' ideas of the term "animal" identified above can affect learning outcomes. The idea of food chains, with plants as primary producers and animals as consumers, is commonly taught even in primary schools, indeed it forms part of the proposed revised programmes of study for Key stage 2 of the National Curriculum (DES, 1991). Bell and Barker's study provides evidence that pupils who have a biologist's view of animal are more likely to understand the concept of consumers than those pupils who still have an understanding of animal based on everyday experience. Bell and Barker compared the results of teaching about consumers with and without prior teaching about the biologists' view of animal. Pupils who were taught about the concept of animal and then introduced to the idea of consumer as an alternative name for animal had greater understanding of the concept of a consumer as part of a food chain.

The research by Simpson and Arnold (1982a) which investigated a number of life processes, including digestion and photosynthesis, illustrated the difficulties which pupils may have in making links between biological processes even when they may appear to understand the underlying concepts. Simpson and Arnold's study revealed the extent of the alternative ideas held by pupils aged eleven years and above, including those concerning the relationship between food, digestion and energy. Although the majority of 12 to 13 year olds appeared to think that energy is obtained from food and that digestion is the breakdown of food, one half concluded that digestion, rather than respiration, is the energy releasing process. The ideas of many pupils concerning energy use in the body was also different from those of biologists; energy was associated principally with movement and feats of strength.

2.4.3 Plant nutrition

The topic of plant nutrition is one which is fundamental to understanding of life processes, including the human food chain. The author's experience that many pupils and primary teachers find the topic difficult is not uncommon; this is not surprising as the topic involves some inherently difficult concepts, for example those related to the processes of photosynthesis. For these reasons it is perhaps understandable that there have been a number of studies which have investigated children's ideas concerning plant nutrition. Much of this research has investigated

the understandings held by eleven year old pupils and secondary school pupils, however many of the findings have relevance for younger pupils.

Simpson and Arnold (1982a), whose study of life processes, including photosynthesis, was outlined earlier, found that the majority of eleven year olds whom they interviewed appeared to understand that plants need energy to grow and that they obtain energy from food. The term food was used in a nonbiological way to describe the substances obtained from the soil; this view was also held by a half of 12 to 13 year olds and a third of 14 to 16 year olds. The role of chlorophyll in the process of photosynthesis was understood by less than a third of secondary pupils and there was little understanding that plants used the food they produced for their own life processes.

In a further study of primary pupils of 11 to 12 years and lower secondary pupils Simpson and Arnold (1982b) found that even secondary pupils may not understand the concepts of living things, food and energy in a way which is scientifically acceptable. For many pupils the everyday use of terms such as food and energy appeared to create difficulties of the type noted in the use of the word animal described earlier (Bell, 1981a).

Further evidence of the understandings of eleven year olds concerning food and photosynthesis comes from the survey by Roth, Smith and Anderson (1983) reported by Bell and Brook (1984; Bell, 1985). The study by Roth et al, which investigated children's ideas prior to and after

teaching, revealed two types of alternative ideas. Firstly, those concerned with scientific facts or principles and secondly, those concerned with scientific ways of thinking. The ideas held by children in the first category included those related to plants and light and food. The survey indicated that eighty per cent of the 229 pupils studied thought that food for plants was obtained from an outside source. Most of these pupils (72%) considered the soil to be the source of food but some also indicated that water (25%) and air (5%) were additional or alternative sources. Only six per cent of children held the scientist's view that plants synthesize their own food. The second category of ideas, identified by Roth et al as deeper level misconceptions, are related to explanations of why plants need light and food. Most of the explanations given by children were non-functional and focussed on the effect of light on plants, for example light is needed for plants to grow, rather than on the way in which light is used by plants. Many children also held alternative views of the function of food, regarding it as something that plants needed in order 'to live' rather than as substances broken down to release energy for metabolic processes.

Support for Roth, Smith and Anderson's findings about plant nutrition comes from the analysis by Driver et al (1984), of responses by 15 year old pupils to one of the questions in the Assessment of Performance Unit surveys which were outlined in Chapter I. The findings raise issues and questions about the teaching and learning of biological concepts. Only eight per cent of pupils gave

responses that matched the biologists' view that plants make tissues from basic constituents taken in from the environment, for example carbon dioxide and water. Some pupils thought that plant growth was analogous to animal growth, they referred to plants 'eating' food. Interestingly there was little difference in most of the responses given by those pupils studying biology and those who were not.

Further information about fifteen year old students' understanding of autotrophic nutrition comes from the CLIS project (Bell and Brook, 1984) as part of their detailed analysis of APU written responses. Bell and Brook sought to discover the extent to which pupils:

1. understand that plant nutrition is autotrophic and not heterotrophic as in animals;
2. understand "the role of light, chlorophyll and raw materials in photosynthesis";
3. "conceptualize the relationship between food, energy and plant metabolism."

(Bell and Brook, 1984, p.1)

The numbers of pupils using scientifically accepted ideas in response to the three APU questions analysed in depth by Bell and Brook was between one third and one fifth. Bell and Brook identified three main alternative ideas used by students, two of which had already been identified earlier by Driver et al (1984), namely that plants obtain their food from the environment and that 'food' for plants is identified as anything taken from the environment, for example minerals and water. The third

alternative idea was that the loss of green pigmentation in plant tissues was the result of factors such as disease or lack of water rather than the result of differences in exposure to light.

In view of earlier research it is not surprising that Bell and Brook found that students frequently had alternative ideas for common words, including food, and for specialist biological terms such as chlorophyll. Bell and Brook stress that the use of such words by students does not imply understanding. Furthermore, students' understanding of the function of food was restricted to the superficial statement 'to stay alive.' Few students had any real understanding of the role of energy in plant metabolism or of the relationships between processes such as respiration and photosynthesis. This finding is supported by other research, such as that by Stavy et al (1987) of secondary students' understanding of photosynthesis which indicated that students frequently considered photosynthesis to be a type of respiration. In their analysis of APU findings Driver et al (1984) found that only one third of fifteen year olds in their sample understood the process of gas exchange in plants.

The findings by Bell and Brook described above are consistent with alternative ideas identified in earlier studies, for example by Simpson and Arnold (1982) and Roth et al (1983). The findings from Bell and Brook's research indicates also the influence of teaching on the level of performance of students; biology students were more likely to give answers consistent with scientific ideas whereas

those students not studying biology were more likely to give responses based on alternative ideas. However, teaching appeared to have a limited effect on the ideas of even the most able students who had studied biology; Bell and Brook note that this group did not use biological ideas with confidence, a significant number (over 25%) gave responses to all three questions which were categorised as alternative ideas. For less able pupils the proportion using alternative ideas was even higher.

The studies by Barker (1985; Barker and Carr, 1989) on teaching and learning about photosynthesis also consider general issues of pupils' understanding about food. Barker's (1985) research was based on interviews with a small group of pupils from 8 to 17 years in New Zealand allied to a more extensive survey using written questionnaires for pupils from 10 years upwards. The questions asked by Barker included ones related to consideration of why some things were regarded as food and others not. The reasons given included edibility and palatability, older secondary pupils also used energy criteria. Barker's conclusions, that young people's concept of food is subject to change and is context dependent, accords with those of Holland (1981), which are discussed in Section 2.5, and Bell and Brook (1984). In considering the implications of the findings for teachers Barker draws attention to the difficulties posed for pupils learning about food and feeding when textbooks and teachers use terms related to food inconsistently. Barker and Carr (1989a) stress the importance of helping pupils to identify

the differences between the concept of eating and that of food, which is essential if they are to understand the concepts of autotrophic and heterotrophic nutrition. Barker's more recent work on photosynthesis has included the development of resource materials for teaching secondary pupils (Barker and Carr, 1989a; 1989b; 1989c) based on the generative learning strategy proposed by Osborne and Wittrock (1985), which is described in section 2.6. The teaching materials developed by Barker and Carr (1989b; 1989c) are of value in helping both students and teachers to clarify ideas about photosynthesis although it appears possible that they may themselves create confusions through the way in which terms such as breathing are used.

The studies which have been reviewed above indicate that the ideas which many pupils have about plant nutrition are different from those held by scientists and that there are patterns in these alternative ideas. These patterns appear to be consistent in many parts of the world as is shown by reports on research from, for example New Zealand (Barker, 1985; Barker and Carr, 1989a), Israel (Stavy, Eisen and Yaakobi, 1987; Eisen and Stavy, 1988) and the Netherlands (Boschhuizen, 1990). There appears to be a need for more collaborative research to ascertain, for example, the importance of language in different contexts and regions. What is apparent also is the relevance and importance of these patterns for teaching and learning about human food and nutrition.

2.4.4 Energy

The concept of energy and energy transfer in biological systems is an important one and was discussed earlier in relation to research on plant and animal nutrition. These studies draw attention to the alternative ideas which pupils have about the concept of energy and metabolic processes in animals and plants. The studies by Bell and Brook (1984; Bell, 1985) highlighted the everyday use of the word energy, such as being energetic, which was different from the scientific view. This everyday use of the word energy is noted also by Watts (1983). Bell (1985) draws attention to the frequent association of the word energy with food, sometimes in ways which indicate alternative ideas held by pupils, for example, if water was considered as a food for living things then it was also thought to contain energy.

Much of the research on children's ideas on energy listed in Figure 24 focusses on understanding of physical phenomena, in particular ideas held by secondary pupils, for example that by Watts (1983), Solomon (1983) and Duit (1983). Some of the studies of children's ideas concerning energy, however, provide information about ideas which younger children have about energy in relation to food. The small scale study by Gosden (1987) which explored ideas about energy held by children aged from five to nine years in one school indicated that many children, including those aged between five and six years, associated the term energy with food. Older children, of eight to nine years, also

mentioned specific foods as energy sources, on occasions using terms such as sugar and glucose when talking about food and energy. It is not surprising that the issues identified earlier with regard to the everyday and scientific use of words by secondary pupils applies also to the use of the term energy in this study by Gosden.

2.5 Children's ideas about food and nutrition

Barker (1985) suggests that one of ^{the} complicating factors in teaching and learning about food is that scientists themselves have no agreed definition of food. Teaching materials, including textbooks, also provide differing definitions. Energy rich components, such as proteins and fats, are always classified as food but the definition is frequently extended to other constituents of the diet including vitamins, minerals and water. The term food, as Barker points out, is used also in a number of different contexts:

- a. Photosynthesis, for example plants making food,
- b. Ecology, for example food webs and food chains,
- c. Human nutrition, for example eating food.

The last context, that of human nutrition, is of particular importance for the study of food and nutrition which follows in Part II and it is therefore being considered separately from the issues of children's understanding in relation to plant and animal nutrition, including photosynthesis, which have been considered in some detail in the previous section. The research discussed earlier

drew attention to some of the ideas which children have about food based on their everyday experience, including its functions in the body, which are at variance with ideas of scientists.

The research which focusses on children's ideas about human food and nutrition, which is summarised in Figure 24, can be divided into that which has investigated children's knowledge and understanding of nutrients, some of which incorporate study of food preferences, and that which looks at the fate of food in the body. Three of the studies, by Contento (1981), Holland (1981) and Newsome (1983) consider food grouping systems and are of particular relevance to the research study discussed in Part II. Research reported by Davies et al (1982) considers more general issues of children's knowledge of nutrition in relation to health.

Children's knowledge and understanding of nutrition and health was one of the areas of health knowledge investigated by Davies et al (1982) for the Health Education Council. Davies and his colleagues used interviews and written responses to questions to probe the views which children and young people held. Although much of their work was with pupils in secondary pupils they talked also to pupils in one primary school. Daily food diaries kept by children were used as a basis for discussion; this technique is one which has been used widely in research into dietary practices, including the national survey of the diets of British schoolchildren discussed in Chapter I (DoH, 1989). Davies and his colleagues investigated children's ideas about the meaning

of terms such as 'balanced diet', the 'quality' and 'quantity' of food, food constituents and ideas about calories. The findings are discussed only in general terms but it appears that the ideas of the children interviewed showed considerable variation. Some primary children understood what is meant by 'balance' in the diet and were able to relate the term to the amount of different food constituents eaten during the day. The nature and function of food constituents, including the function of proteins, vitamins and fibre in the diet, was rarely understood by children below the age of twelve years.

Contento (1981) studied a small sample of thirty-four children aged from 5 to 11 years in the U.S.A.; the children represented a variety of socio-economic classes and religious backgrounds. Although the sample of children is a small one the procedures and findings are of interest. The research was designed to provide a description of what children understand about food and snacks, the changes that food undergoes in their bodies, and the effects of food on their bodies. Contento also attempted to establish the extent to which children applied their knowledge and understanding in making food choices.

The research by Contento was closely linked to children's thinking at the preoperational and concrete operational levels described by Piaget (Piaget and Inhelder, 1966) which were discussed in Section 2.1. Children were grouped into preoperational and concrete operational levels on the basis of standard Piagetian tasks, including conservation of substance (Piaget, 1929)

and classification of animals tasks (Inhelder and Piaget, 1964) allied to a classification of foods task using pictures developed by Contento. Contento identifies preoperational level children by the way in which they classified pictures of food items using irrelevant variables; concrete operational children understood the idea of a hierarchy of classification.

Contento used semi-clinical individual interview procedures of the type used by Piagetian researchers (Piaget, 1929) starting with open-ended questions and then asking more specific questions. The questions probed two areas:

1. The child's conception of food and the process of eating;
2. Food preferences.

Discussion of food preference was linked to actual choices of snacks at the end of the interview when children were offered a selection of six snack items. Half of the snack items were classified as more nutritious, for example fruit juice or peanuts, the remainder were 'less' nutritious, for example candy. Although many children were able to distinguish which snacks were more nutritious most chose snacks from the less nutritious group, for the understandable reason that they liked them! The recognition that choices may be governed by preference rather than knowledge illustrates the interactions between the multiple factors which determine food choice which were discussed earlier.

Children identified as being at the preoperational

level classified everything that was edible as food; they did not appear to distinguish between the terms "foods" and "snacks". Concrete operational children consistently distinguished between snacks and foods; snacks were items eaten after or between food. It appears from Contento's analysis that the term food was being used as a synonym for the term meal by the older children interviewed.

The understanding of the children interviewed by Contento concerning vitamins is of particular interest. With few exceptions all of the children believed that vitamins were pills that made people "strong or healthy" (Contento, 1981 p.88). Only two of the children understood that vitamins were assimilated into the body, although these children did not understand the relationship between vitamins and food. Only seven children, all in the concrete operational stage, considered vitamins to be both pills and part of food. The ideas about where vitamins were located in particular foods, for example the "white stuff in apples", indicate that the children did not appreciate that foods are composed of chemical constituents.

The interviews revealed that children in the sample had little idea of what happened to food once it was swallowed. Few children, and only those above the age of nine, used nutrient terms, for example, protein, in describing the changes which occur to food during digestion. Only three children demonstrated any understanding of such nutrient terms. Contento comments that children saw no connection between the concept of

nutrients as components of food and their personal experience of eating food. The findings are not surprising, nutrients are abstract concepts which many adults have difficulty in explaining.

Contento draws attention to the importance of her findings in relation to curriculum materials. She suggests that any materials used in teaching about food and nutrition should take account of children's understanding and provide experiences and information which is related to the child's everyday life. Emphasis on nutrients is inappropriate in such materials, for example in food grouping systems.

The subject of food grouping systems used by children forms the context for Holland's (1981) study of the classification strategies employed by children in dealing with familiar materials. The research was a continuation of earlier studies into children's speech in different contexts and was linked to Bernstein's sociolinguistic theory (Bernstein, 1971, 1975). Holland considers her results therefore in relation to social class differences with children assigned to two categories, working and middle class, based on parental occupation. The author questions the assumptions on which the research is premised but nonetheless feels that the methods used to ascertain what children understand about food are relevant to the study described in Chapter III.

Holland interviewed eight and ten year old children from four schools in London. Twenty-four coloured photographs of familiar food items, mainly items which

could form part of school meals, were used as the basis of a classificatory task; the food items included animal products, for example sausages, vegetables and cereal products, for example bread and biscuits. The purpose of the task was to ascertain the principles which children used in classifying familiar materials; it was not intended to assess skills.

Holland identified five groups of responses, which were coded according to whether they were context dependent or independent:

1. General principles - the basic context independent category which was subdivided into three groups:
 - i) similar constituents e.g. butter and cheese,
 - ii) common food category e.g. vegetables,
 - iii) food origin e.g. sardines and fish fingers from sea;
2. Everyday use - the basic context dependent category:
 - i) directly related to child's experience, e.g. food eaten at Sunday lunch, likes and dislikes were included in this group,
 - ii) meal groupings.
3. Food attributes e.g. taste or all sweet things. Holland identifies this group as a context dependent category which is most like the independent category;
4. Perceptual e.g. colour, shape - context dependent;

5. Ambiguous - context dependent where basis of groupings is not clear e.g. they go together.

The responses indicated that when grouping food items children most commonly used general principles and everyday use categories. Throughout the interviews children found context independent categories easier to recognise than to produce, with middle class children demonstrating greater facility in both producing and recognizing context independent categories.

Holland's work provides information about children's ideas and understandings, however, it is based on a small and not necessarily representative sample of children. The research highlights one of the limitations of single interventions, namely that they do not monitor changes in children's thinking which may take place in the period immediately following the interview. Nor in this instance was it clear whether any teaching on food took place prior to, or after, the interviews.

Holland's findings have implications for teaching about food grouping systems as do the findings from research by Newsome (1983). Newsome's study was based in secondary schools; however, it has considerable relevance to the research which is discussed in Part II, both in terms of its location in schools in inner London and in the use of a classification of foods exercise based on pictures of food. Furthermore some of the interviews described in Part II were with children of 11 to 12 years; Newsome's findings provide a useful frame of reference for the interviews with these children and an indicator of where

continuity and progression may be achieved.

Newsome's research was undertaken in six schools with 751 pupils between the ages of 11 and 16 years. The investigation consisted of a number of discrete elements including:

1. Pupil questionnaire concerning food values, norms, beliefs and food behaviour;
2. Classification of foods exercise where pupils were asked to sort fifty-four pictures of foods into groups. The activity was undertaken by pupils working in groups.

The findings from Newsome's research provide a wealth of detail about the eating habits and beliefs and understandings of young people about food. Personal preferences, allied to social and cultural factors governed pupils' values, beliefs and habits regarding eating behaviour. Health considerations were of secondary importance. The responses to the questionnaire indicated that most pupils (69%) chose foods because they were liked; only fifteen per cent made selections for health reasons. Interesting distinctions were made by young people between weekend foods and foods eaten at other times; at the weekend habit and tradition governed food choice.

The results from the Newsome's (1983) classification activity were similar in some respects to Holland's (1981) findings, especially if the types of groupings are compared. Unlike Holland, however, Newsome was interested in the classification systems which pupils used and the implications of these for teaching, not the orientation in

meanings. The majority of pupils in the 159 groups who carried out the exercise classified foods into food types, for example meat or vegetables. Newsome defines this grouping system as one based on objective criteria; it corresponds with Holland's (1981) context independent general principles group. About fifteen per cent of the groups used subjective criteria, for example grouping foods which were liked or using meal grouping system; this grouping corresponds with Holland's everyday use or context dependent category. About a third of pupils (52/159) used more than one classification system, for example food items allied to a meal grouping system. A particularly important finding was that only three groups used a nutrient grouping system. Pupils rarely used the food grouping system taught even where this was a meal based system designed to aid food choice, such as the Aquarian system devised by Finch (1978) which is discussed in Section 2.6. Newsome draws attention to the difficulties which pupils experienced in classifying certain foods, for example milk which could be classified as protein, as dairy produce and as a liquid, or 'dishes' composed of more than one food item, for example pizza. Newsome argues that food grouping schemes used in schools should be perceived to be relevant by pupils and should be linked to their existing eating patterns.

Newsome's findings provide evidence that ethnicity appears to be more closely associated with eating patterns than socio-economic factors. The responses to the questionnaire also indicated the extent of what Newsome terms 'inter-cultural' food change, stereotypic patterns of

eating cannot be assumed. The implications of this research for nutrition education in a multicultural society are important, as is the further evidence that pupils respond to nutrition education materials at both cognitive and affective levels.

Evidence about pupil's understanding about the function of food and the importance of specific nutrients in the body comes from research by Wellman and Johnson (1982), Magarey et al (1986) and Resnicow and Reinhardt (1990) as well as other studies, such as those of Gellert (1962), which have investigated children's understanding of internal body organs and their functions.

The research by Wellman and Johnson (1982) focussed on conceptions of food and body functions held by children aged six, nine and twelve years. Each of the forty-five children interviewed was presented with two tasks. In the first task children were asked to consider what caused differences between individuals, for example height, weight and health. The second task focussed on children's ideas about the consequences of different food inputs for identical twins. Children at all three ages recognized that some foods were 'good' foods, for example, they made you stronger, healthier, and that some foods were 'bad'. Wellman and Johnson suggest that the children interviewed knew that food was not the only factor in determining, for example weight, other factors such as exercise were also involved. There were differences, however, in understanding between the three age groups, most notably in the children's explanations of nutritional relationships

and processes. Younger children had less understanding of such relationships; they thought for example, that food and water were equally important in nutritional terms.

Wellmann and Johnson's findings about children's understanding of relationships can be related to earlier discussion about children's ideas about plant nutrition (Bell and Brooks, 1984) and to studies reported by Carey (1985). Carey suggests that although young children may appear to be aware of the relation between food and various body processes they do not begin to understand the physiological mechanisms involved until the age of nine or ten at the earliest. Evidence to support this argument comes from Gellert's (1962) investigation of the understanding which children between the ages of 4 and 16 years had of internal body organs and functions. Gellert's study indicated that it was only around the age of ten years that children appeared to conceive of the body as being composed of a number of organs with specific functions.

The study by Magarey and her colleagues in Australia (Magarey et al, 1986) was based on individual interviews which investigated children's understanding of nutrients and the reasons why food is eaten. One hundred and fifty of the 220 children in the study were from a cohort of seven year olds whose growth and nutrition have been studied from birth; the remainder of the children, aged seven or ten years, were randomly selected from local primary schools. During the interviews children were shown photographs of foods and asked to identify those which they

thought contained sugar, water, fat, salt, protein and vitamins. They were also asked to classify foods as 'good' or 'bad for you'.

The findings indicated that there was little difference in the ideas held by children of different ages although, as might be expected, ten year olds had greater knowledge of the function of nutrients in the body. The findings suggest that children had little understanding of the nutrient content of foods although, as a group, seven year olds recognized that foods like apples, carrots and milk contained vitamins and that potato chips contained fat and salt. For most children taste or appearance were the usual way in which they identified whether foods contained specific nutrients, although ten year olds on occasions identified television and food labels as sources of information. Children regarded some nutrients, notably vitamins and proteins as 'good' and others, for example salt and sugar as 'bad'. Almost all the children (96%) thought that water was good for them, although few could explain why water was needed in the body. Children were rarely specific about the effect of nutrients on the body; the exception was sugar, which was often related to tooth decay, which, the authors suggest, may reflect the emphasis on dental health in South Australia. Very few children appreciated that foods containing specific nutrients could be 'good' and 'bad'.

Two thirds of the children interviewed gave what Magarey et al classify as general or mechanistic answers to the question 'Why do we eat food?', for example, food was

needed to keep people alive or to enable them to grow. Approximately one third related food intake to health. The numbers of children linking food intake to energy was very small, one per cent of seven year olds and six per cent of ten year olds. Magarey et al also asked children what they thought happened to food after it was eaten; their results were consistent with those of Gellert (1962) and Carey (1985) which were discussed earlier, which indicated that children below the age of ten years had little understanding of what happened to food once it was ingested.

The study by Resnicow and Reinhardt (1991) is similar in some respects to the National Children's Survey (Department of Health, 1989), which was discussed in Chapter I, in terms of its scale and in the way in which it used questionnaires to provide information about large numbers of children. The purpose of the two surveys was however different; that in the UK sought information about food intake and eating patterns whilst that by Resnicow and Reinhardt was intended to provide information about children's knowledge and understanding about fat, fibre and cholesterol.

The survey reported by Resnicow and Reinhardt involved over five thousand children in five states in the U.S.A. in primary and secondary schools; most of the children in the sample attended inner city schools. The intention of the research at the primary level was to evaluate the 'Know Your Body' (KYB) teaching materials which were being introduced into schools. The KYB project is designed to

provide children with the knowledge, attitudes and skills to make positive health choices.

The results from the survey indicated that children of all ages appeared to be aware of the value of a healthy diet. They equated fibre with health and recognized that eating foods which were high in fat and cholesterol was potentially harmful. Children had, however, limited knowledge and were also confused about the fibre or cholesterol content of specific foods. There was a tendency for primary school pupils to assume that all 'good' foods contained fibre and all 'bad' foods contained cholesterol, for example, fifty per cent of primary children thought fish (a 'good' food) contained fibre and that sugar (a 'bad' food) contained cholesterol. Reniscow and Reinhardt suggest that there is a need to establish whether the confusions which exist are the result of insufficient teaching or related to the development of the child. The reasons for the confusions could be more complex; they may be related to the factors identified in Figures 1 and 2 which influence food choice, including the media.

The studies discussed above provide a useful starting point for further investigation of children's understanding of food and nutrition. Some authors, specifically Newsome (1983) and Reniscow and Reinhardt (1991) raise a number of issues in relation to teaching about food, including the teaching strategies to be used, the content of teaching materials, the age at which teaching about, for example, cholesterol and fibre, should start and what classification

systems should be used. These issues will be discussed in more depth in the following section (2.6) and in later chapters.

2.6 Approaches to teaching about food and nutrition

The earlier discussion on children's learning (sections 2.4 and 2.5) drew attention to the extension of the research on children's ideas into developing teaching strategies which were consistent with constructivist ideas about learning. Some of the research outlined considered the effects of teaching on student's ideas. The discussion of approaches to teaching which follows focusses on this research, which the author considers to have important implications for teaching and learning about food and nutrition and to be of direct relevance to the study of children's ideas about food which is discussed in Part II.

Those engaged in research on children's ideas in science have based their work in classrooms and the implications of the research for classroom practice have been identified in many instances. The model of teaching and learning which is generally promoted is premised on learners actively constructing their own meanings (for example Driver, 1980, 1982; Driver and Erickson, 1983; Pope and Gilbert, 1983). Such models are not new. Ausubel (1968) identifies the importance of finding out what the learner understands and then making links between this knowledge and what is to be taught. Wittrock (1974, 1977) suggests that the meanings and concepts held by learners,

based on their prior experiences and attitudes, should be utilized to help them to generate new, and useful, meanings and concepts. Such views accord also with Piaget's ideas about the construction of knowledge by the individual which were discussed earlier.

Driver, Guesne and Tiberghien (1985) suggest that taking account of children's ideas is a useful strategy, albeit not the only one, for enhancing learning outcomes. They outline a number of ways in which teachers can promote teaching based on what is known about the general patterns of ideas held by children, namely:

1. Identifying appropriate concepts to teach;
2. Selecting learning experiences which will promote changes in thinking;
3. Clarifying the purposes of activities.

The importance of ensuring that there is a match between the teacher's intended learning outcome and the learner's response is endorsed by Osborne and Wittrock (1983) in their generative learning model. This model recognises the way in which the learner selects and processes information, for example from materials used during a lesson, to extend and to reconstruct knowledge which is based on prior experiences. In this model new ideas may either exist alongside existing ideas, or be rejected, or be used to restructure ideas and so construct new meanings. Freyberg and Osborne (1985) point to the limitations of the generative model, including the practical difficulties in restructuring children's ideas. They suggest that although teachers have an important role

in organising and providing appropriate, relevant and interesting learning experiences, it is the learner who has the ultimate responsibility for learning outcomes. Osborne and Wittrock (1982), and also Osborne and Freyberg (1985), agree with Driver and her colleagues (1985) about the importance of teachers making clear the intention of the lesson or activity.

The role of the teacher which emerges from the discussion above is that of a facilitator who motivates and guides pupils, who allows time for discussion of ideas and who, furthermore, is able to act as diagnostician. Most importantly the teacher values and acknowledges learners' ideas. There are marked similarities between the role of the teacher described here and that identified in the Plowden Report (DES, 1967), which was discussed in Chapter I, and the 'Interpretation' teacher identified by Barnes (1976). Barnes suggests that the teacher's role is to set up a dialogue in which learners can reshape their knowledge by interacting with others. The role of the teacher is similar to that which is implicit in the model of learning in health education discussed earlier in section 2.3. Osborne and Freyberg (1985) draw attention to the importance of teachers as innovators and experimenters who are concerned with the effect of their teaching on what they term the "pupils' view of reality" (p.98). They indicate also the value of teachers engaging in research. The type of teacher identified by Osborne and Freyberg epitomizes the reflective practitioner identified by Schon (1983) which was discussed in the Introduction. The notion

of the teacher as reflective practitioner and researcher will be returned to and examined in more detail in Chapter V.

A feature of much of the research on children's understanding in science in the past decade has been the emphasis on identifying ways in which teachers can develop teaching strategies which are consistent with the model of teaching identified above. Ideally such strategies should permit ideas to be identified and challenged and provide scope for restructuring of ideas. Although the details of the strategies proposed by different authors differ the overall framework is similar.

Barnes (1976), who identifies the importance of learners formulating their own knowledge, stresses the value of small group activities in learning. He outlines a lesson framework in which four stages can be identified:

1. Focussing stage in which the topic is presented to the whole class, teachers direct pupils attention and pupils ask questions;
2. Exploratory stage which involves discussion and activities in small groups;
3. Reorganising stage in which the teacher refocuses attention and pupils prepare for reporting back to the whole class;
4. Public stage which includes reporting back and further discussion of outcomes.

The framework identified here is a familiar one in primary classrooms. In theory such a framework permits children's ideas to be explored, at the focussing stage, and challenged, for example at the exploratory stage. Such

lesson frameworks also facilitate the use of the full range of language which Barnes regards as a requirement for learning to take place.

Rowell and Dawson (1983) suggest strategies which focus more explicitly on the confrontation of children's ideas. Rowell and Johnson were concerned with what happens when the results of scientific experiments are contrary to the expectation of the child; they call such incidents counterexamples. They argue that the new theory must be introduced as a powerful alternative if children are to accept a new theory to explain such counterexamples. The teaching strategy they advocate consists of five stages:

1. Questioning by the teacher to establish the ideas that children hold;
2. Acceptance of children's ideas as possible solutions;
3. Teachers put forward alternative ideas, children are asked to retain their original ideas;
4. Teaching of 'new idea' linked where possible, to basic ideas already held;
5. Recall of old ideas and comparison with new idea.

Rowell and Dawson stress the value to teachers and children of identifying children's ideas at all stages of the strategy outlined above. The authors do not view their procedure as threatening the child who, they suggest, can retain both old and new ideas alongside each other until such time as the new, more powerful ideas are tested against others and accepted as the best explanation.

Gilbert and his colleagues (Gilbert et al, 1982)

suggest that the more modest aim of helping children to become aware that there is an alternative viewpoint, that of the scientist, may be more successful in many cases than attempting to restructure children's ideas. This argument is developed further by Solomon (1983) who suggests that there is no need for children's prior ideas to be rejected; the old, or socialized knowledge, can be retained alongside the new scientific explanations. Solomon argues that children should be helped to think in what she terms the "two different domains of knowledge" (p.50) and be able to distinguish between them. Solomon's proposal is of particular relevance to ideas relating to food and nutrition, where there is a need for children, and adults, to understand social meanings in order to communicate and to operate effectively.

The generative learning model outlined by Cosgrove and Osborne (1985) and Osborne and Wittrock (1985) recognises the importance of teachers analyzing their own views as well those of scientists and children. This focus on the understanding of teachers is of particular relevance in the context of primary teachers whose own experience of science may be limited, an issue which was identified in Chapter I (section 1.2.3) and which will be returned to in later chapters. The main difference between Cosgrove and Osborne's model and that of earlier writers is the teacher preparation phase which allows teachers to check their own understandings of scientific concepts. They suggest that one way in which this process can be achieved is by providing teaching materials which give information about

both children's and scientists' views. Cosgrove and Osborne's four phases can be summarised as:

1. **Preliminary phase**, where teachers ascertain typical ideas held by children and scientists about a topic as a means of understanding the scientific view, survey ideas of children in their own class and classify these ideas;
2. **Focus phase**, where teachers establish contexts for pupils to explore ideas, where possible in relevant everyday situations, interpret and elucidate children's ideas; children clarify ideas and present views to groups and class;
3. **Challenge phase**, in which the teacher facilitates an exchange of views and accepts views of children; children consider all views proposed and test validity by seeking evidence; consideration of scientist's views;
4. **Application phase**, where children solve practical problems linked to scientific concepts; evaluation of activities; sharing and clarification of ideas.

Cosgrove and Osborne stress the importance of making the purpose of the focus stage explicit to pupils. This factor was considered earlier when the importance of such clarification was identified as a prerequisite for pupils taking responsibility for their own learning.

The generative learning model outlined above is one which can be translated into classroom practice, however the author's experience of working with teachers indicates

that teachers require support in developing and implementing teaching strategies based on constructivist principles. A number of the research teams engaged in studies of children's ideas, including SERU in New Zealand and CLISP at Leeds, have developed teaching materials, based on their research findings of conceptual frameworks, for example the lesson units on 'Approaches to Teaching Plant Nutrition' (CLISP, 1987). The research reports by CLISP have also proved, in the author's experience, rich sources of ideas for pre- and in-service work with primary and secondary teachers.

An important facet of the CLIS projects is the way in which they involve teachers in research programmes and in the development of resource materials and also support teachers through in-service programmes. Joint research allied to ongoing support, in the author's view, is a vital element in the translation of theory into practice, as is the establishment of networks of teachers and schools as a means of promoting teaching which is consistent with constructivist views of learning. Although the earlier work of CLISP focussed on work with secondary pupils current projects include work with primary teachers and children (Asoko, Leach and Scott, 1991). One such project, which involves collaborative research, is investigating the nature of progression in children's ideas, for example in relation to diversity and classification, as part of a programme which is linked to the National Curriculum in science.

The Science Processes and Concept Exploration (SPACE)

project, based at the Universities of Liverpool and London, is a further example of recent classroom based research which aims to establish the ideas which children have in particular science concept areas, for example growth (Russell and Watt, 1990) and evaporation (Russell, Harlen and Watt, 1989), and to develop teaching approaches and materials based upon research findings. The project is seeking to investigate the extent to which it is possible for children to develop more 'scientific' ideas as a result of relevant classroom experiences and interventions. Although researchers and teachers have worked closely together during the research phase of this project, the structure and implementation of the study is researcher led. Teachers have been encouraged to incorporate project techniques, such as the eliciting of children's ideas, into their teaching. A major outcome of this research project will be the development of curriculum materials as part of a new Nuffield Primary SPACE course which will be linked to the Science National Curriculum.

Each of the concepts studied in the SPACE research programme has been organised into a pilot plus four phases:

1. Exploration
2. Pre-Intervention Elicitation
3. Intervention
4. Post-Intervention Elicitation

During the exploration phase children engaged in activities set up in the classroom and were encouraged to keep log books in which they recorded, for example, changes in growth of plants. During this phase teachers noted

children's ideas but undertook no direct teaching of the topic. Further activities included completion of pictures and discussions with teachers. The elicitation phase included researchers collecting data by means of individual interviews and work with small groups; the same children were interviewed in both elicitation phases. The information from the first elicitation phase was used to inform the intervention phase when children were encouraged to test their ideas in a scientific way, to develop more scientific definitions for key words, and encouraged, by means of discussion, to generalize from one specific context to others. The intervention also provided children with opportunities to test their own ideas against the 'right' idea.

There are obvious similarities between the strategies used in the SPACE project and those described earlier, for example, Rowell and Dawson (1983), and the generative learning model of Cosgrove and Osborne (1985). However, there are also differences of emphasis and approach, for example in the exploration phase. The idea of children's diaries and log books is one which has been promoted previously by Harlen, for example as part of the Science Teacher Action Research (STAR) project (Schilling et al, 1990); it is a strategy which has value particularly where change over time is being monitored, for example in eating patterns.

The SPACE project has, in the same way as the SERU (Osborne and Freyberg, 1985) and the CLIS (CLISP, 1987) projects described earlier, increased our understanding of

children's ideas about scientific concepts. The project has also provided further information about collaborative research involving pupils and teachers and viable classroom strategies for teaching about scientific concepts in ways consistent with constructivist learning theory. A major outcome has been the broadening and deepening of teachers' understanding of, for example, the process of plant and animal growth, and an apparent increase in primary teachers' confidence when teaching science.

The approaches to teaching and learning outlined above are of significance for science in general and in particular for nutrition education which incorporates learning in both social and cognitive domains allied to consideration of attitudes and behaviour. Furthermore the models of teaching and learning discussed in this section are consistent with approaches outlined by the DES (1989) for science and technology and the guidance on health education by National Curriculum Council (NCC, 1990) discussed earlier (Section 2.2 and Chapter I, Section 1.2.4). The emphasis on teaching which acknowledges and utilizes children's ideas reinforces notions of relevance in nutrition education suggested by a number of authors including Christian-Carter (1980) and Ingle and Turner (1983).

Christian-Carter (1980) in her study of curriculum development in nutrition in secondary schools draws attention to the importance of pupils identifying the relevance of nutrition teaching. She suggests that pupils who see the relevance of nutrition knowledge and its

applications for their own lives will derive greater enjoyment from learning about food and will also have more favourable attitudes towards diet and eating habits. Her study, which was based on consideration of teaching styles and learning outcomes in home economics lessons, also provides evidence of the importance of encouraging students to take more responsibility for their own learning. Christian-Carter's suggestions based on her findings are in close accord with those promoted recently by the NCC (1990b).

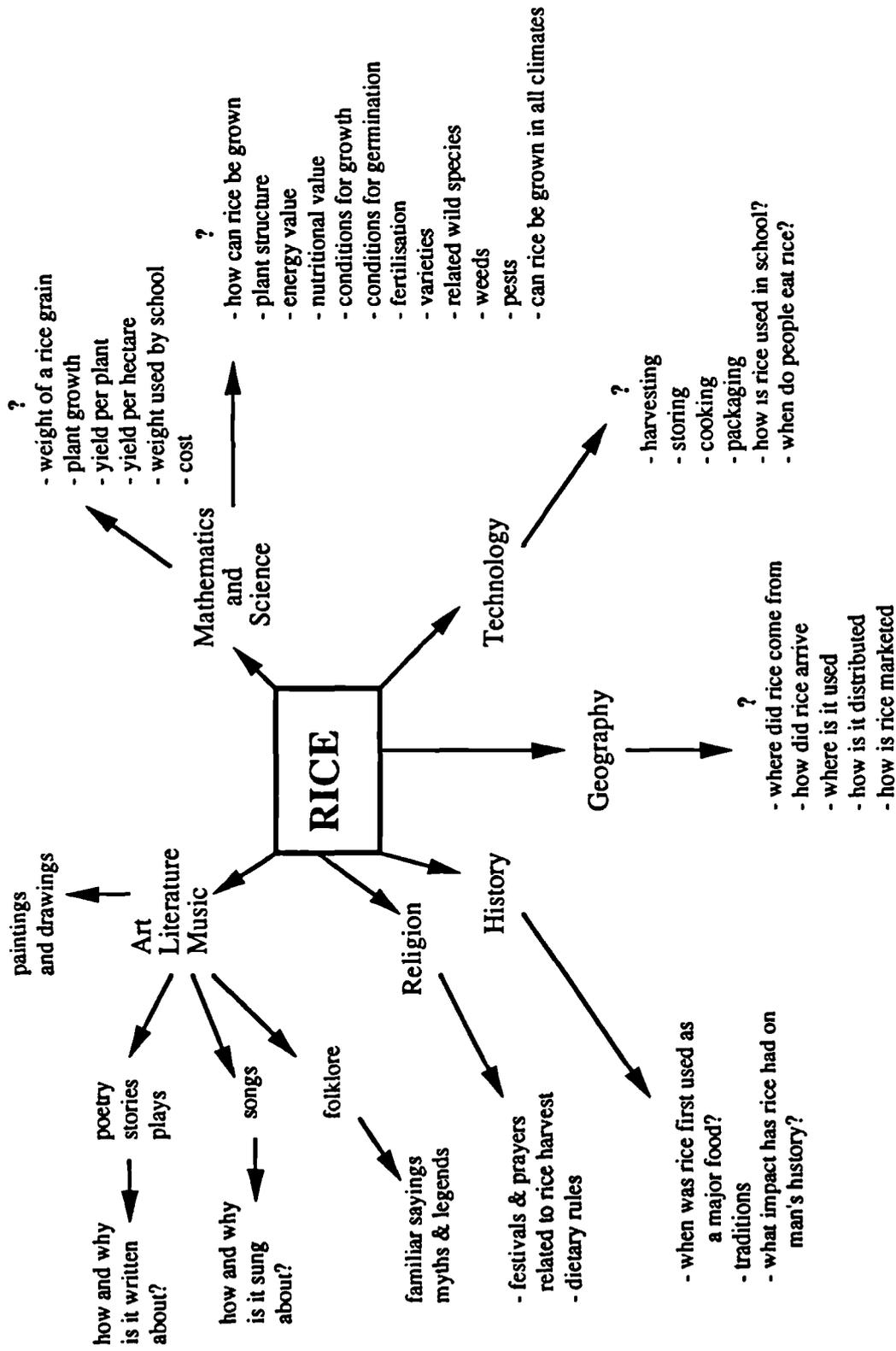
Evidence of strategies used by teachers to stimulate interest and understanding about food and nutrition comes from surveys such as that by Gordon and Calloway (1977) and Turner and Ingle (1985) and from information gathered by Unesco (van der Vynckt and Barclay, 1984) as well as research discussed in previous sections, for example Williams et al (1985).

The questionnaire survey by Gordon and Calloway provided information about nutrition education programmes in 135 countries. They collected information about the organization of nutrition education programmes in schools, curriculum development and the resources and methodologies used in teaching. Although at the time of the survey the most commonly used methodologies were lectures and demonstrations, a number of countries listed further methods which they felt to be worthwhile. These methods included small group work and problem solving activities. Relating nutritional health to the decision making process as a means of helping children to take responsibility for their own health was mooted by North America. This last suggestion is

an interesting one as the USA and Canada both have long running nutrition education programmes.

Turner and Ingle's (1985) survey of teaching approaches used in nutrition education in twenty countries revealed that there was widespread recognition of the need to move away from rote learning to more active participation by learners. The range of methods used to encourage active learning included the use of discussion, practical investigative activities and drama. An important finding of the survey was that there was a dearth of suitable up-to-date teaching material, including reference materials for teachers. The survey highlighted the importance of in-service teacher education (INSET) and the need to consider nutrition education in a more holistic way which facilitated links across the curriculum and incorporated consideration of the social, economic and cultural factors governing food choice and availability. The potential value of relating school meals and school garden projects with classroom teaching was frequently ignored although its importance was stressed by the authors. Ideas for making links between classroom teaching and school meals were considered in greater depth at an international conference on School Feeding Programmes and Education (Guruge, 1986). Specific examples of how links could be made between school meals and classroom teaching in primary schools were considered, as is illustrated in Figure 26 (Turner and Frost, 1986), which makes suggestions for questions which could form starting points for a study of rice in different areas of the curriculum. The need for active participation by pupils is

Figure 26 'A Grain of Rice' - Developing a Cross-Curricular Topic



Source: Based on Turner and Frost (1986)

stressed, with children taking responsibility for their own learning.

One outcome of the survey of teaching approaches by Turner and Ingle (1985) was the production of a series of manuals containing ideas for teaching nutrition education by Unesco (van der Vynckt and Barclay 1984; Barclay and van der Vynckt, 1984;) which incorporated ideas of good practice worldwide. The manuals do not provide a theoretical framework for teaching about food and nutrition: however, they do provide suggestions for ways of helping children to group foods as a means of selecting diets which promote health. The Unesco grouping system is based on a three group system consisting of 'Go, Grow and Healthy Helpers' in which some foods from each group should be eaten every day. 'Go' foods include staples such as rice or bread plus fats and oils; 'Grow' foods consist of foods high in proteins, namely meat and alternatives such as pulses; the 'Healthy helpers' consist of vegetables and fruit. The Unesco system outlined here is derived from traditional groupings used throughout the world which are based on a staple food plus additions. Although useful for primary school children, the Unesco system has limitations in that, for example, the staple food often contains vitamins and minerals, the so called 'Healthy helpers' and the 'Grow' foods incorporate staples plus oils and fats which in many countries would be grouped separately. The system is also one in which children are passive receivers; it does not recognize or build on the ideas which children already possess.

The issue of food classification was discussed earlier in Section 2.5 in relation to the work of Contento (1981), Holland (1981) and Newsome (1983). Contento (1981) drew attention to the need to develop systems that are more perceptually based and less dependent on formal structures. Such classification schemes, she suggested, should be related to foods that children eat and the food choices which they make in everyday life. One food grouping system which has used methods similar to those advocated by Contento is the Aquarian system developed by Finch (1978a; 1981). Finch argues that any meal grouping system should firstly enable sound food choices to be made, secondly should be easily workable and thirdly should form a logical basis for more advanced studies in nutrition (Finch, 1978b; 1981). Finch suggests a four group system based on:

1. 'Mains' food consisting of meat, fish and dairy produce;
2. 'Fillers', which includes cereals, pulses and potatoes;
3. Fruit and vegetables;
4. Drinks.

The drinks group includes a number of liquids, such as soups and gravies, which children do not normally consider as drinks. Although the Aquarian scheme in theory builds on children's experience of meals the classification system used does not involve children actively in its construction. The scheme is based also on notions of meals which may no longer be applicable in the UK, as is indicated by the survey of the diets of British

schoolchildren (Department of Health, 1989) which was discussed in Chapter I. Furthermore, the Aquarian scheme largely ignores issues of cultural diversity. The Aquarian system is not limited to food grouping, it suggests active approaches to learning about food which accord with ideas implicit in, for example, science and technology in the National Curriculum (DES, 1989; 1990) which were discussed in Chapter I. Although the Aquarian system has not been widely adopted in schools, later materials, for example those developed by the Inner London Education Authority (ILEA, 1985), have incorporated some of Finch's ideas.

Questions remain about the value of the food grouping systems which have been developed and which are used in schools, including those discussed above. Grouping systems on their own, as Sinacore and Harrison (1971) point out, have little value; what is required in nutrition education is the development of eating habits which will promote health. Newsome's (1983) study showed that even meal based systems, such as the Aquarian system designed to promote sound eating habits, were rarely used spontaneously by pupils. There appears to be a need to reconsider the classification systems taught in primary schools in the light of what is known of children's ideas.

2.7 Teachers' ideas about food and nutrition

The generative learning model advocated by Cosgrove and Osborne (1985), which was discussed in section 2.6, drew attention to the need for teachers to analyze their own ideas prior to teaching about scientific concepts. The importance of such analysis for teachers in primary schools was also identified.

Gilbert et al (1982) point to the wide range of viewpoints held by teachers which, they suggest, range from children's science to scientists' science; in this context scientists' science is viewed as the consensus view of the world and scientific terminology held by the scientific community. Evidence that primary teachers' views may be different from those of scientists comes from studies which were discussed in section 2.4, for example those reported by Bell and Freyberg (1985). Fensham (1979) suggests that teachers' views of science may be different from both children's and scientists' views. The way in which teachers' ideas of science interact with the curriculum and in the development of materials for use in teaching may or may not lead to teaching based on scientists' science. The results of this interaction, as Gilbert (1982) points out, have profound implications for teaching and learning outcomes.

Indirect evidence about primary teachers' ideas comes from the study by Lucas (1987) of adults ideas about biological concepts. In this survey over one thousand adults throughout Britain were asked a series of questions,

which included two about food and nutrition. The responses were analysed in relation to the highest educational level reached in both science or non-science subjects, for example 'O' and 'A' level. In the first of the two food related questions people were asked to say which substance, from a list which contained protein, minerals, vitamins and carbohydrates provided most of the energy needs of the body. In the second question they were given a list of pairs of foods, for example beef and cheese, beef and potatoes, and asked to say which pair of foods were both high in protein.

The responses showed little difference between male or female but there were differences in responses given by those respondents with higher level qualifications and those without. Only fifty per cent of those with 'O' level qualifications in science considered that carbohydrate provided most of the energy needs of the body, the remainder considered that the main energy sources were protein (35%) or vitamins (13%); sixty-four per cent of those with 'A' levels identified carbohydrates as providing most energy needs. A larger proportion of the group with 'O' levels, sixty-five per cent, thought that beef and cheese were the pair of foods highest in protein; a response similar to those respondents with 'A' level qualifications. The responses to these two questions, as Lucas points out, suggest that people recognize which foods contain specific nutrients but are less certain of the functions of nutrients. He suggests that everyday language use, including that in advertising, may be one of the

factors determining the number of responses, including those from science graduates, which are different from those of scientists. Obviously these results do not provide information about primary teachers' understanding about food; however, the survey does provide an indication of alternative ideas which may be held by some teachers, especially those who may not have studied science beyond 'O'/GCSE level.

O'Connell, Shannon and Sims (1981) identify a further factor which needs to be considered in addition to teachers' knowledge about food and nutrition, namely the attitudes and beliefs held by teachers about both nutrition and nutrition education. Although there are difficulties in measuring attitudes accurately, as O'Connell and her colleagues acknowledge, some of the studies of teachers' attitudes towards nutrition education are of interest. The findings by Peterson and Kies (1972), who assessed the nutrition knowledge and attitudes of elementary school teachers in the U.S.A., indicated that there was little relationship between teachers' knowledge and their attitudes to teaching nutrition. Later research by Cook, Eiler and Kaminaka (1977) suggested that the attitudes of teachers towards teaching depended on how much time they spent teaching nutrition; the attitudes of those teachers who taught the subject more frequently were more positive. It could be argued that Cook's findings are not unexpected; teachers gain in confidence as they teach topics more frequently and as a result are likely to have more positive attitudes towards the subject. Studies by O'Connell et al

(1981) in the U.S.A. which investigated the attitudes of teachers towards teaching nutrition and the effect of in-service education on these attitudes, support Cook's findings. O'Connell et al found that the elementary teachers who participated in the study had positive attitudes towards nutrition and nutrition education and that in-service education programmes served to reinforce these already positive attitudes. The beneficial effect of nutrition courses for teachers was most marked with pre-service teachers who, whilst considering nutrition education as an important area to be taught, were less interested in and committed to teaching about nutrition.

Current research based in the Science Education Department of the Institute of Education includes the CHATTS project (Children and Teachers Talking about Science), which is seeking to explore the ideas which primary teachers have about a range of science concepts, including food irradiation. The project involves teachers discussing and clarifying their ideas prior to evaluating teaching materials and considering ways of teaching particular topics. This project can be seen as a further development of earlier research into children's ideas and the generative learning model proposed for teaching strategies by Cosgrove and Osborne (1985).

Issues of teachers' understanding about food and nutrition and the way in which such ideas impinge on teaching will be discussed in more detail in Part II.

2.8 Summary

The review of teaching and learning about food and nutrition in this chapter has considered relevant learning theories and aspects of learning in the area of nutrition, health and science education which impinge on both cognitive and social learning and on attitudes to food and food behaviours.

The chapter has focussed on research which has explored children's ideas about concepts relating to food and nutrition and on teaching strategies which recognize the importance of these ideas for children's learning. The differences between children's ideas and scientists' ideas have been analysed in relation to food and nutrition, including animal and plant nutrition. Issues relating to the use of language in science and in everyday life, including the use of words such as food and energy, have been identified as a factor which is important in teaching and learning about food and one which merits further study. The review of children's ideas about food and diet has also indicated that there is a need to reconsider the food classification systems used in schools.

The implications for teaching of studies on children's ideas have been examined in relation to relevant learning models and to teachers' own ideas about food and nutrition. The review has focussed on teaching strategies which enable teachers to identify the understandings which children hold and has examined the ways in which teaching based on constructivist ideas can be promoted.

The models of teaching and learning identified in this chapter provide the contexts for the study of children's ideas and teaching strategies in food and nutrition which will be considered in Part II.

PART II

**INNOVATION IN NUTRITION EDUCATION -
CASE STUDIES IN TEACHER EDUCATION**

CHAPTER III

Promoting curriculum change through Inservice Teacher Education

3.1 Introduction

In Part I a number of factors were identified as being important in promoting curriculum change including central government policy as well as Local Education Authority (LEA) and school policies. Teacher education, including in-service provision for serving teachers, can also be instrumental in curriculum change. At the core of any changes in schools are teachers whose professional confidence and competence, allied to a willingness to try out and to adapt to new ideas, will be the deciding factor in determining implementation of change. This chapter focusses on possible ways in which confidence and competence can be developed in science education through Inservice Teacher Education (INSET) which is linked to participatory research related to nutrition education.

The importance of teacher competence has long been acknowledged as a prerequisite of good practice, as is evident from statements made in reports which have been instrumental in shaping the structure of teacher education in the past thirty years. The influence of training on the professional development of individual teachers shows considerable variation and is often difficult to evaluate

in terms of classroom expertise. Discussion with teachers reveals that there is more agreement concerning the major role that experience plays in the development of teaching competence than over the extent to which professional training can enhance this competence but ideally experience and professional training complement each other.

With the implementation of the National Curriculum in England and Wales (DES, 1989) major curriculum development could be viewed as resting solely in the domain of the National Curriculum Council. However, the grass roots curriculum development which has often been associated with teacher education, particularly in-service teacher education (INSET) programmes, will continue to be of importance in implementing National Curriculum guidelines as is acknowledged by the Department of Education and Science (DES, 1989, para. 90). Curriculum change has to be viewed, therefore, in the context of changing patterns of professional training and support, which in turn can be regarded as indicators of government policy.

Teacher education and curriculum development have to be considered also in relation to other factors discussed earlier in Chapters I and II, for example changing ideas concerning teaching and learning in specific areas of the curriculum.

This chapter examines possible ways in which in-service education might promote curriculum change in primary schools through the professional development of teachers. Courses run by the Science Education Department of the Institute of Education, the Diploma in Primary

Science Education and courses for Coordinators of Science in Primary Schools are used as case studies to investigate how change might be effected and to illustrate how links can be made between theory and practice.

3.2 Inservice Teacher education - provision and purpose

The foundation of current provision for in-service education for teachers (INSET) can be traced to recommendations made in the James Report, "Education and Training" in 1972 (DES, 1972). This report was particularly influential in drawing attention to the role and importance of teacher education.

"The best education and training of teachers is that which is built upon and illuminated by growing maturity and experience."

(DES, 1972 para 2.1)

The report also provided a model of how both initial teacher education and in-service education (INSET) could develop in the following decade. The improvement of INSET was seen as a first priority of the Committee, who viewed it in very broad terms as comprehending the:

"whole range of activities by which teachers can extend their personal educational development, personal competence and improve their understanding of educational principles and techniques."

The Report stressed that all teachers should have:

"opportunities to extend and deepen their knowledge of teaching methods and educational theory"

at regular intervals throughout their careers. The Committee placed great importance on in-service education based in schools. Schools, it stated, should regard the "continued training " of teachers as an essential part of their work, with all members of staff sharing responsibility for such training. The views of the Committee on the value of in-service training were explicit:-

"All teachers need to keep abreast of the results of educational research and experiment, and to be informed about the use of new books, materials and equipment."

(DES, 1972)

Although the author, and no doubt the majority of those engaged in education, would concur with this statement it has to be recognised that opportunities and support for professional development are essential if the vision is to be translated into reality. The emphasis in the James Report on opportunities for INSET was therefore particularly welcome.

The James Report outlined ways in which INSET could be developed with schools working in partnership with teacher training institutions. Regrettably many of the most innovative and far reaching recommendations of the James Report were not implemented. These included regular opportunities for extended study leave for teachers for inservice education. Other proposals, particularly those concerning INSET, have gained gradual acceptance and have been implemented with support from the Department of Education and Science and by Local Education Authorities

(LEAs). The greater emphasis on partnership between schools, LEAs and training institutions which has been characteristic of DES supported INSET provision for science in primary schools since 1983 (Circular 11/83, DES, 1983) can be traced to proposals mooted in the James Report.

Since the publication of the James Report in 1972 both the DES and Her Majesty's Inspectorate (HMI) have continued to advocate the idea of professional development through regular INSET (DES, 1978; DES 1985). The influential HMI report on primary education in 1978 (DES, 1978) reiterated and endorsed the views of the James Report. Teachers, HMI said, could not be expected "to master all they need in one short burst of training." Initial training needed to be followed by a "supporting pattern of inservice education and training" (DES, 1978) throughout a teacher's career. The pattern of INSET envisaged by HMI included work in schools as well as out of school provision; it could involve observing other teachers, discussions with staff, including those from other schools, headteachers, inspectors and staff from teachers' centres.

Provision for INSET in the past ten years has included a mixture of DES funded INSET, for example Educational Support Grant (ESG) funding for subjects such as science and technology, LEA supported INSET and days designated for school based in-service programmes. The introduction of devolved budgets for schools as part of the Education Reform Act (1988) means that schools now have greater autonomy in planning and implementing their own INSET programmes. This mixture of provision is, to some extent,

a further indication of the importance given to the need for ongoing school based in-service programmes. However, it also represents the development of more direct DES intervention and control of the curriculum which, as was discussed in Chapter I, was signalled in "Better Schools" (DES, 1985) and which culminated in the National Curriculum proposals (DES, 1987).

Although the reports and papers cited above provide some insights into current views of INSET provision, the links between that provision and curriculum development are complex and not easy to determine. The importance of INSET in effecting curriculum change has received official acknowledgement during the past decade (DES, 1985a and DES, 1985b, DES, 1989). It is also reflected in the marked shift towards more school based in-service curriculum development.

A further element in INSET provision since 1983 has been the increased support given to specific subject areas, most notably science and technology. The Discussion paper produced by HMI Science Committee on science in primary education (DES, 1983a) reiterated the importance of in-service training for all schools and the need for adequate support for teachers if primary schools were to develop programmes for the teaching of science. Circular 11/83 (DES, 1983b), which outlined proposals for 35 day INSET programmes for Co-ordinators for Science in Primary Schools, provided financial support of the type which was necessary if the suggestions for science in primary schools outlined by HMI were to be implemented. Circular 11/83

heralded not only increased and direct DES funding for science based INSET but also a different form of INSET, in which LEAs, schools and INSET providers should work in partnership - a form of INSET envisaged earlier by the James Report. The circular also signalled greater DES control of INSET provision since all 35 day course proposals had to be approved by the DES. The intention was that the courses should be developed jointly by LEAs and INSET providers; furthermore they should provide opportunities for participants to update and to extend their knowledge of science and to develop the management skills required for successful subject coordination. The emphasis on scientific knowledge was not surprising in view of the findings of HMI in 1978 (DES, 1978) which had highlighted the lack of science expertise amongst primary teachers. As was indicated in Chapter I, the HMI Report had identified the small number of primary schools with teachers who had responsibility for science. There was, therefore, as Frost and Turner (1987) indicate, no tradition of coordination in science on which to build.

Although the importance of the 35 day Co-ordinators for Primary Science courses has been recognised and valued by participating teachers (Frost and Turner, 1987) and LEAs, they could be criticised for only affecting relatively small numbers of schools. However, many of the teachers who participated in the courses were promoted, frequently to new advisory teacher posts for primary science created with Educational Support Grant (ESG) funding for science and technology, and were therefore in a

position to extend and to develop ideas generated in the original courses. The author suggests that this form of INSET, although suffering from the inherent dilution effect of any 'cascade model', has achieved many of the original aims concerning subject coordination and the development of science in the primary curriculum.

Responsibility for funding the 35 day Co-ordinators for Primary Science programmes was transferred from the DES to LEAs in April 1989 with the introduction of new forms of funding for INSET programmes, namely Grant Related INSET (GRIST). Initially this change had little impact on the 35 day programmes but it resulted in a fall in the numbers of Co-ordinators seconded to the courses in 1989/90. Although the importance of these courses was recognised by the DES and LEAs, the problems associated with funding of supply cover under GRIST created difficulties. The changes in funding arrangements coincided with the introduction of the National Curriculum in September 1989 with science as a core subject. As someone working closely with primary teachers throughout this period the author was aware, as were many others, of the continued widespread lack of confidence amongst teachers expected to teach science as part of the National Curriculum. The difficulties related to the teaching of science and the need for continued INSET were acknowledged by the DES in 1990 when they reintroduced centrally funded INSET programmes for science for coordinators in primary schools and extended the provision to include courses in science for classroom teachers. The form of negotiated INSET was similar to that introduced in

1983 but in this case provision was limited to 20 days (DES, 1990). This more limited provision is certainly not the ideal: however, it has to be viewed in the context of other changes which have occurred in the past eight years. The range of school and LEA INSET provision for primary science is now far more extensive than it was in 1983; resources and resource provision are also greater and include support from a range of professional bodies, most notably the Association for Science Education. It is now the norm for primary schools to have a coordinator for science and well defined policies for science. The needs and priorities for coordinators in the 1990's are therefore different from those identified in 1983.

3.3. Developing science based INSET programmes for primary teachers

The discussion of INSET provision for primary teachers which follows focuses on two complementary programmes developed in the Science Education Department of the University of London Institute of Education. The first of these programmes is a Diploma course in primary science education and the second the extended INSET courses of the type outlined in Section 3.2.

The Science Education Department has been associated with initial teacher education and INSET provision in secondary teacher education for over sixty years: its involvement with science education in primary schools is more recent. The department's major involvement with INSET

in primary schools began in 1983 with the commencement of the Diploma in Primary Science Education.

The Diploma course was developed by the author in association with her colleague, Mrs Jenny Frost, in response to concerns expressed about science education by HMI in their Report on Primary Education (DES, 1978) and after discussions with HMIs with responsibility for science. It was designed for experienced primary and/or middle school teachers who wished to extend and to update their knowledge of science and science education. It was envisaged that the majority of teachers would study part-time and the course and course assignments had therefore to recognise the constraints faced by teachers undertaking such a course.

The course had a number of distinctive features, including coursework assignments which were school based and related to curriculum development in science and health education. The written assignments were designed to help teachers to clarify their ideas about science and health related issues and, in particular, to permit reflection on practice in ways which have been described by Walker (1985) and Schon (1983, 1987) and which were discussed in the Introduction (p.27). A major consideration in 1983 was the need to define what type of science was appropriate for primary schools and how science might be implemented in the light of findings from the Assessment of Performance Unit (APU) reports on science at age 11 (APU, 1981).

In 1984 the Science Education Department was amongst those institutions invited by the DES to put forward plans

for a thirty-five day course for Co-ordinators of science in primary schools as proposed by DES Circular 11/83 (DES, 1983). The proposal for this course, as has been outlined earlier in Section 3.2, was different from most previous in-service programmes in which the Institute of Education had been involved. The course content was to be developed as a result of discussions with HMI, Local Authority Inspectors and Advisers, teachers and providing institutions. The intention was that the course should address the needs of participating schools and teachers and be the forerunner of a network of local support and in-service provision. The notes of guidance from the DES (February, 1984) provided a framework for course content which covered the teachers' knowledge and understanding of science, the place of science in the curriculum, including its links with other areas of the curriculum and the development of management skills. Opportunities for curriculum development at course and school level were not precluded by this brief, indeed it provided the possibility for long term and ongoing school based curriculum development and research.

The DES notes of guidance recommended specific areas of content for inclusion in courses for Science Coordinators as follows;-

"The course should extend the teacher's knowledge and understanding of scientific method and a range of major science concepts; consider the role and organisation of practical, investigative science as well as criteria for the selection and progressive

development of content; emphasize the monitoring of pupils' progress in science and the ways work can be matched to their differing needs and abilities; take account of safety matters and recent developments in science education (not least the work of the APU); consider the cross curricular implications of science especially links between science, mathematics and language work, and review recent science curriculum development projects." (DES, 1983)

The mention of cross curriculum links is particularly important for broad based topics such as those related to food and nutrition which incorporate aspects of health education.

Emphasis was placed also on the development of management skills for organisation of resources and to "help course members support and guide other less confident members of their school, teaching science." The responses to the pre-course questionnaire given to 35 day course participants at the Institute of Education (similar to those shown in Appendices II and III) indicated that management skills were regarded as particularly important by the teachers, especially by younger teachers who were working with older, more experienced colleagues.

Interestingly the DES provided guidance about the pedagogy of the course:

"It will also be important for teaching methods to encourage maximum participation of course members at all stages. With this in mind it will be unlikely therefore that formal lectures will occupy more than

20% of available time."

(DES, 1983)

The principle of workshops, practical activities and seminars led by teachers was already an established element in the Diploma in Primary Science Education course at the Institute. The value of workshops in in-service programmes has gained widespread recognition in recent years amongst teacher educators although, as Harlen indicates (Harlen, 1983), there is no research evidence to suggest that workshop trained teachers are 'better' than teachers trained in other ways.

The DES courses also had to include school-based assignments which:

"should involve the headteacher and other members of the school science staff, be concerned with the formulation of a science policy in the context of the course members's own school and be directed towards the design and implementation of a science scheme for all pupils."

(DES, 1983)

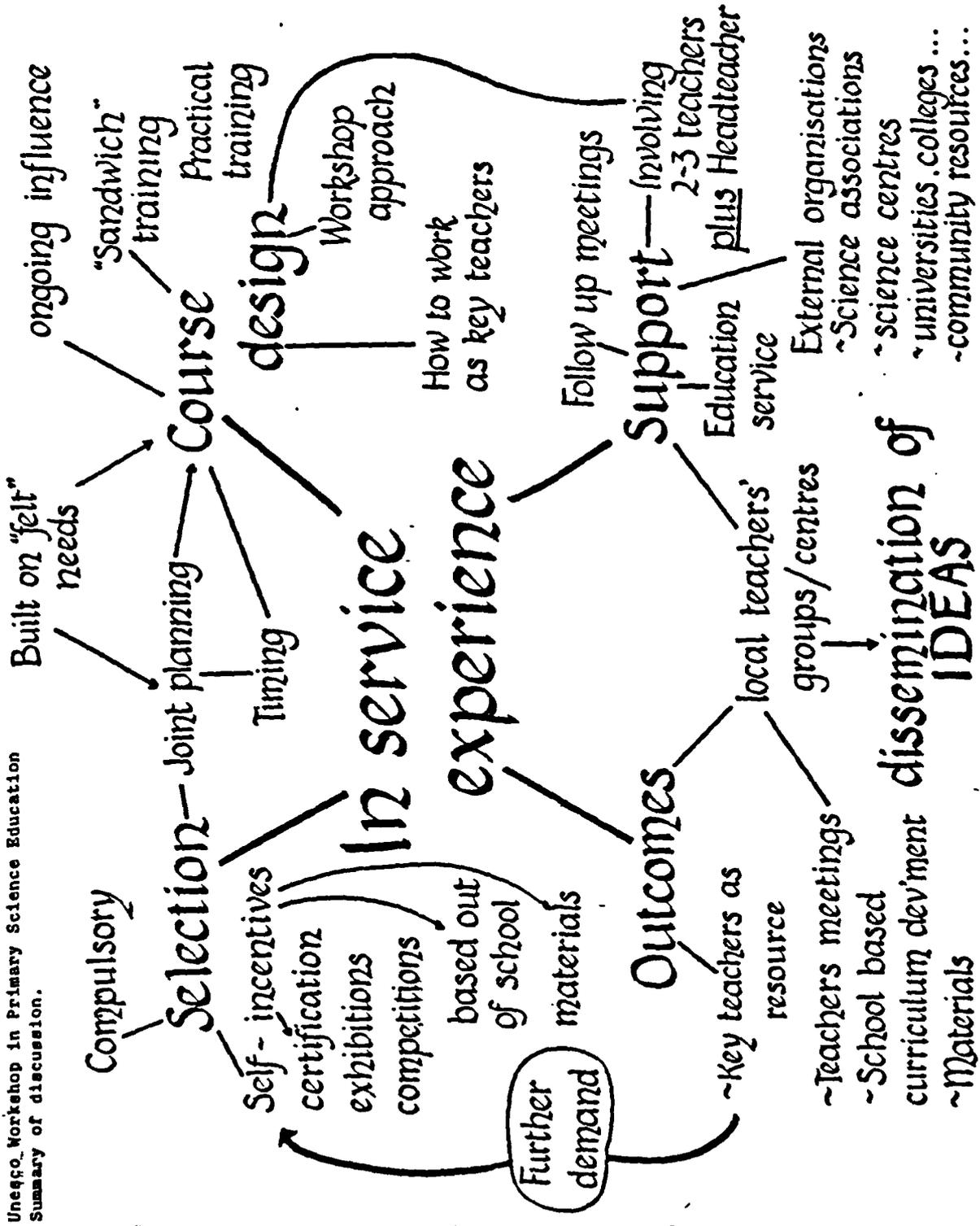
The type of course envisaged by the notes of guidance was in many respects similar to that of the Diploma in Primary Science Education course which had commenced at the Institute of Education in September 1983; the major difference was the emphasis placed on the development of management skills and whole school involvement. The school based assignments also resembled those developed for the Diploma course. These resemblances between the framework outlined by the DES for Coordinators courses and that already implemented by Science Department Diploma course were not fortuitous: they reflected in part the results of

regular discussions with HMI with responsibility for science prior to 1983 and were influenced by the results of the survey of primary schools reported by HMI in 1978 (DES, 1978). Discussion with HMI and colleagues involved in INSET programmes elsewhere revealed that there was agreement about many of the difficulties facing primary teachers. There was also a willingness to explore ways in which these difficulties might be overcome.

As posts of responsibility for curriculum subjects, particularly in science, were relatively new in primary schools in 1984, there was no body of experience upon which to draw in planning the details of the course for Coordinators. It was decided that the course should embody the positive elements in the Diploma course including school based activities. Participants were also asked to write reports on these activities. The course was planned to be the equivalent of one year of the two year part-time Diploma in Primary Science Education course; this structure permitted teachers to undertake a second year of part-time study and to obtain the Diploma in Primary Science Education. It is worth noting that the programme for the Co-ordinators' course accords with views expressed at a Unesco workshop on primary education, held in Bangalore in 1985, which included representatives from some twenty-five countries (Harlen, 1985). The model of inservice provision developed at this meeting and summarised in Figure 27 is similar in many respects to the Co-ordinators' course at the Institute of Education. Factors such as ongoing inservice provision linked to support from headteachers and

Figure 27

A model for in-service programmes



Skala Terep 1987

other staff and the negotiated programme built on "felt needs" reflected current thinking in many regions of the world.

The first assignment that teachers on both courses undertook involved interviewing individual pupils about selected scientific concepts. The interviews were intended to serve a number of purposes. Firstly, the interviews should alert teachers to the range of ideas held by pupils in a class; this knowledge would enable teachers to monitor children's progress more effectively. Secondly, the interviews should help teachers to clarify their own ideas about science concepts which many found problematic. The purpose of the written assignments in helping teachers to reflect on practice has already been mentioned; such reflection could also prove to be of value in planning and reporting on teaching science based topics later in the course. Lastly, the activities were capable of modification so that teachers were not only introduced to the value of educational research for teaching in schools but were also encouraged to engage in such research.

The move to 20 day courses for coordinators in 1990/91 has not altered the nature of the tasks which participants undertake, although the amount of coursework work has been reduced. It is planned to retain the interviews with children as an important element in the course.

3.4 Action research as part of in-service education for teachers.

Research has been defined by Mouly (1978) as the process by which "dependable solutions" may be found to problems by means of "planned and systematic collection, analysis, and interpretation of data". This general statement is sufficiently broad to permit inclusion of educational research for which traditional research techniques, particularly the methods of applied scientific research, are not always appropriate. Educational research in its broadest sense encompasses many facets of work in schools including, as is suggested in the James Report (DES,1972), the review and evaluation of the school's objectives and results.

Criticism has been voiced in the past about the non-scientific nature of educational research. Borg (1963) suggests that the inefficient and unscientific methods used by educators in acquiring knowledge and solving problems have slowed progress in education. Overdependence on personal experience and uncritical acceptance of opinion unsupported by objective evidence are both cited by Borg as characteristic of problem solving techniques used by educators. Such criticisms are valid. However, there is a place in educational research, as Cohen and Manion (1986) indicate, for both normative approaches based upon scientific method and for interpretive approaches. They suggest that interpretive and subjective perspectives, such as those gained from case studies and accounts, can provide

complementary insights to those based on the scientific paradigm. Indeed the very complexity of the educational process necessitates the use of a range of methodologies. Educational research can also utilise the scientific method when focussing on specific problems in a specific setting as in the case of action research.

Halsey (1972) defined the process of action research as "small scale intervention in the functioning of the real world and a close examination of the effects of such intervention." Cohen and Manion (1986) suggest that such research has four main features:-

1. **Situational:** it is concerned with a particular context;
2. **Collaborative:** practitioners and researchers work together as a team;
3. **Participatory:** team members are instrumental, directly or indirectly, in implementing the research;
4. **Self-evaluative:** there is continuous evaluation of modifications, the ultimate objective being to improve practice.

The four features identified by Cohen and Manion provided a useful framework in considering how teachers following the Diploma and Coordinators in Primary Science courses at the Institute could become involved in collaborative research of the type categorised as action research. The context for the research was provided already by one element of the course, namely the interviews with children about particular scientific concepts. In

1988 the interviews with children were extended and developed to provide the basis of a research programme which focussed on children's ideas about food and diet.

The research had three specific purposes:

1. To find out more about the ideas which children hold about food;
2. To investigate how the professional development of teachers could be furthered by:
 - i. developing their awareness of the understandings which children have about ideas related to food and health,
 - ii. increasing teachers' own knowledge and understanding in one area of science and health,
 - iii. providing teachers with opportunities to reflect on practice;
3. To investigate how the findings from collaborative research could be used to develop new teaching strategies and/or to extend existing strategies used by teachers.

The work with teachers centred on four questions:

1. What are the ideas which young children hold about food?
2. On what basis do children make food choices?
3. What strategies can teachers use to find out more about children's ideas about food?
4. How can information on children's ideas about food be used to further both the professional development of teachers and curriculum development?

The author considered that by sharing experiences and

working as a team, rather than as individuals, teachers could be helped to recognise the importance of their individual investigative work with children. It was possible that patterns in the results could have profound effects on the ways in which teachers taught topics subsequently and in how they assessed pupils. The sharing of ideas and results with colleagues in schools could lead to curriculum change and development which was not limited to the classrooms of course participants.

3.5 Investigating ideas which children have about food

3.5.1 Research methodology

The research programme centred on interviews which teachers following the Diploma in Primary Science Education and Coordinators for Science Education in Primary Schools undertook with children in school. Each teacher was asked to interview three children in their class, representative of the class in terms of background and ability, and to tape record the interviews if possible. They were then asked to write a report based on these interviews and their findings; where appropriate the reports should include edited transcripts of the discussion with pupils. An outline of the research programme is shown in Figure 28. As can be seen from this figure the programme had five main elements:-

1. Introduction to research;
2. Interviewing children in school;

3. Discussion about interviews;
4. Writing of reports;
5. Feedback and analysis of results.

1. Introduction to research

During this introductory session teachers were provided with background information about the research.

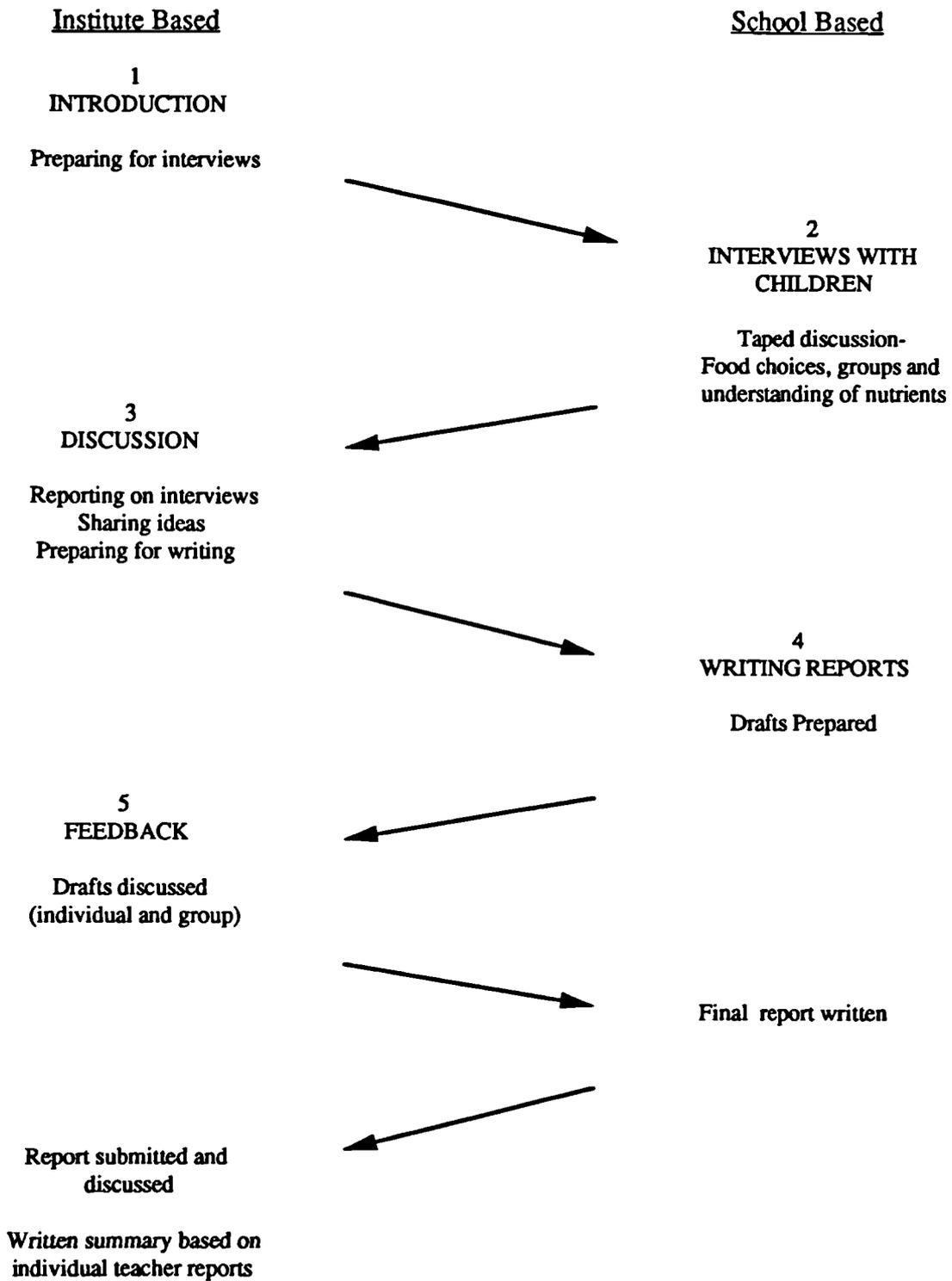
Teachers completed a questionnaire concerning their own understanding of food (shown in Appendix IX), listed questions they wanted answered and identified teaching strategies which they might use with children.

Teachers then tried out the activities in the interview schedules themselves. Trial interviews with colleagues were tape recorded and used as a basis for discussion of issues, including the standardisation of questions and interview procedures, and of the underlying nutrition concepts; teachers were also encouraged to ask questions. Teachers then modified materials to suit the needs of their own pupils.

2. Interviewing children in school

Each teacher interviewed three children; the interviews were structured and lasted approximately thirty minutes. Tape recordings were made of the interviews and report forms completed for each child. Additional comments were noted during the interviews or recorded immediately after the interview.

Figure 28. Outline of Research Programme



3. Discussion about interviews

The discussion included a reporting session at the Institute where teachers talked about the interviews and their findings, made comments on the activities and raised further questions that they wanted to ask. Small group and individual interviews also took place with the author.

4. Writing of reports by teachers

Following the interviews teachers wrote reports on the interviews. During the writing of the reports teachers were encouraged to discuss drafts and given verbal and written feedback on these drafts

5. Feedback and analysis of results

Feedback from teachers included comments about the interviews and the nature of the research, with ideas for modification of the programme and interview structure.

Feedback to teachers was provided in two ways;

- a. comments to individuals on their reports,
- b. written summary report of the findings of the group (the summary for 1988/89 entitled "Vitamins Are Good For You" forms Appendix IV) which included analysis of the results and comments from individuals about the implication of their findings for teaching.

For all students the research programme took place

during one term. Diploma students undertook interviews in the first term of their two year course in 1988/89; in 1989 the Diploma course became a modular course and the interviews became part of the second module, "Learning and Assessment in Science". For Co-ordinators following the 35 day programme between 1988/1990 the interviews formed part of a three week block programme at the start of the course. Those teachers following 20 day courses for curriculum co-ordinators which began in 1990/91 also undertook interviews at the beginning of their course. Group and individual discussion about the interviews took place as soon as possible after the interviews. Draft reports were discussed in individual tutorials. All students submitted final written reports at the beginning of the term following the interviews with children, so that vacation periods could be used for writing.

Data from the interviews were collected by means of report forms (shown in Appendix VI) which teachers completed during the interviews, from edited transcripts of the interviews and from oral and written reports by teachers.

Although the framework for the research programme, allied to course assignments, was clearly defined, it was considered important that the research programme should be sufficiently flexible to respond to suggestions made by teachers. The principle of negotiated research was considered to be very important. In practice teachers did not want to alter the interview structure, although details, such as questions about nutrients, were altered to

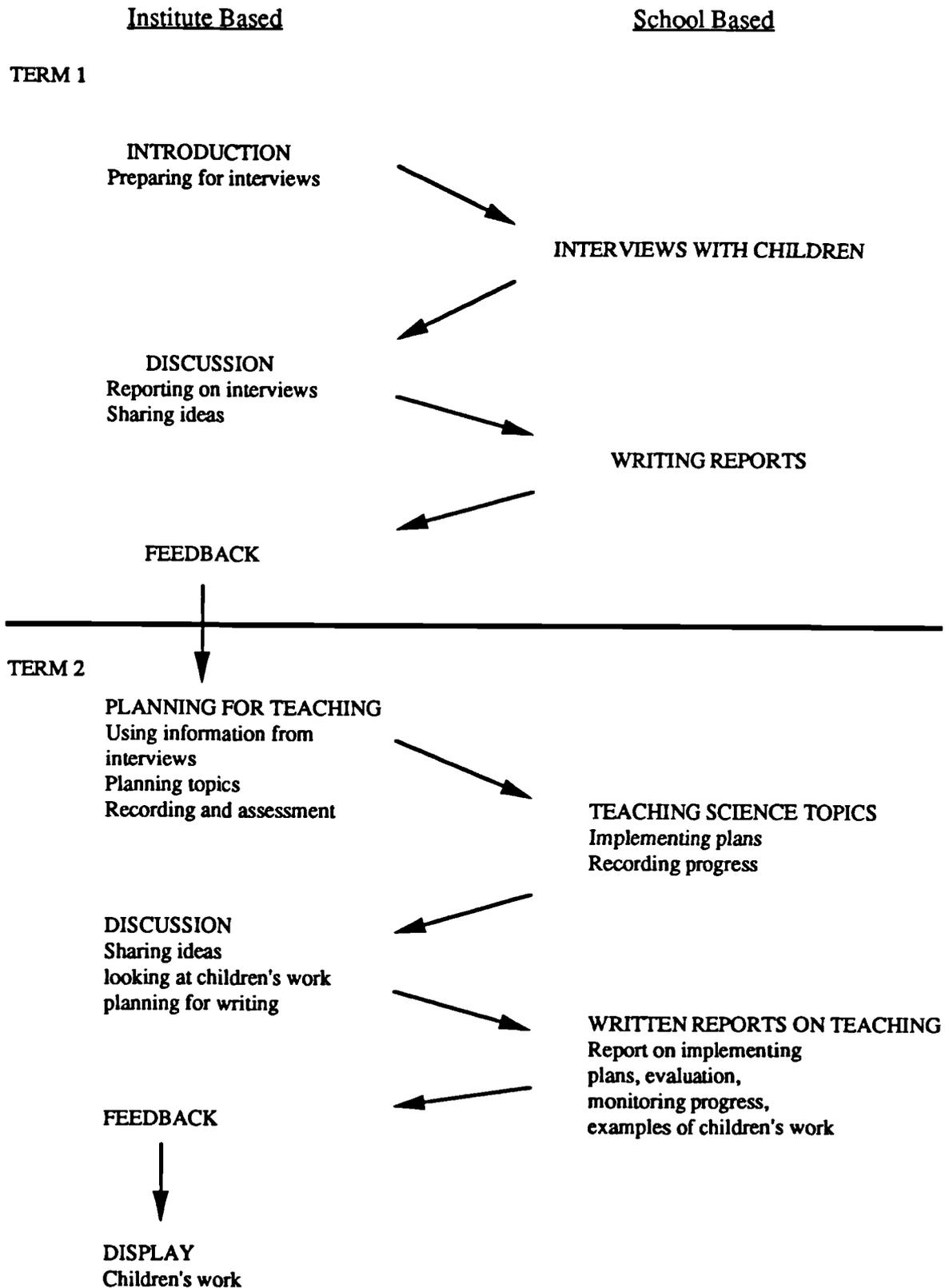
meet the needs of specific groups, for example those children who were not proficient in English. A small number of teachers worked with nursery children aged 3 to 5 years and for these children larger pictures of foods were preferable or, better still, food items themselves.

The research programme was linked to other parts of the Diploma and INSET courses. Planning for teaching science based topics incorporated further discussion of the implications for teaching of the interview findings, including health education and assessment; the links between the research and other parts of the course are illustrated in Figure 29. The course programme also included further work on the topic of food and health. The questionnaires, which teachers had completed prior to their interviews with children (shown in Appendix IX), were used as a starting point for exploration of their own ideas and of possible teaching approaches which could utilise the findings about children's ideas. Summaries of the teachers' responses, of the type shown in Appendix X, were used to inform and to extend discussion, as was the summary report of the findings from the interviews which is shown in Appendix IV.

Feedback about the ways in which teachers were using the results of the research to inform and to develop their teaching came from activities undertaken later in the course programmes. Teachers also taught a science based topic and wrote an evaluative report on their teaching, as is indicated in Figure 29 and Appendix XI.

Figure 29

Diagram to illustrate the relationship between different elements of the courses for primary teachers



3.5.2 Teachers and schools

The sample population for the study was composed of teachers following the Diploma in Science Education and the 35 day Coordinators in Primary Science courses (1988/90) and 20 day Curriculum Coordinators for primary science course (1990/91). The number of teachers who participated in these courses between 1988 and 1991 and who completed reports is shown in Table 1. From the Table it can be seen that during the three year period of the study seventy teachers interviewed children and wrote reports on their interviews.

All the teachers worked in primary or middle schools in the London area. The schools include those situated in inner London boroughs (which were part of the Inner London Education Authority until April 1990) the outer London boroughs and counties, such as Essex, which are within a thirty mile radius of London. The schools vary in size and composition; with the exception of one independent girls' school all the schools are mixed. Most schools have Infant and Junior departments on one site although this is not always the case; even when housed in one building Infant and Junior departments frequently have a great deal of autonomy. Although the majority of schools in which the teachers work are primary schools, a small number work in outer London boroughs which have First and Middle schools with transfer to High Schools at the age of twelve. The majority of the schools in the sample have pupils with varied cultural backgrounds and many speak English as a

Table 1

Numbers of teachers reporting on interviews with children

1988 - 1991

YEAR	DIPLOMA	COORDINATORS	TOTAL
1988/1989	10	17	27
1989/1990	14	12	26
1990/1991	6	11	17
Totals	<u>30</u>	<u>40</u>	<u>70</u>

Table 2

Numbers of children interviewed 1988 to 1991

YEAR	DIPLOMA	COORDINATORS	TOTAL
1988/1989	27	51	78
1989/1990	42	37	79
1990/1991	18	37	55
Totals	<u>87</u>	<u>125</u>	<u>212</u>

second language. The schools in which the teachers work are representative of inner city and urban schools in the South East of England.

The age, experience and background of the teachers is varied. The minimum entry requirement for the two courses is a teaching qualification plus three years of practical teaching experience. The majority of teachers embarking on the courses have a Certificate in Education or Bachelor of Education degree; few have specialist subject degrees plus a Postgraduate Certificate of Education, even fewer have a science or science related degree. Although the teachers participating in the Diploma and Coordinators courses have similar backgrounds and experience, there are two significant differences between the two groups:

- i) the Diploma course is open to any suitably qualified teacher who wants to undertake the course; those following the Co-ordinators in Primary Science course are nominated by their Local Education Authority and Headteachers;
- ii) Diploma students do not necessarily have responsibility for science in their schools (although many do); Co-ordinators are expected to have responsibility for science (there have been exceptions).

These differences mean that the needs of the students in the two groups are not identical. Their expectations of the course also differ, as is revealed by analysis of the responses to precourse questionnaires (see Appendix II). Coordinators more frequently mention the need for

management skills in running meetings and organising resources as well as help in organising in-service training for colleagues. The majority of students in both groups mention the importance of further study in science to improve their competence in teaching science based topics. The fact that Diploma students elect to study at the Institute is an important factor in determining how individuals perceive the course. The experience of many providers of INSET which was reported at an International Workshop organised under the auspices of Unesco in Bangalore in 1985 (Harlen, 1985) indicated that the results of inservice activities were longer lasting if participants were self selecting.

3.5.3 Children

As has already been indicated, the schools in which the participating teachers worked were very varied in terms of size and location. The background of the pupils was equally diverse. The children chosen for the interviews were regarded as representative of the background and ability of the class as a whole.

A total of 212 children were interviewed. The number of children of different ages and sexes interviewed is shown in Tables 2 and 3. From Table 3 it can be seen that the majority of the children interviewed were aged from five to eleven years. Those children aged over twelve years were pupils in Year 7 in middle or secondary schools. The total number of girls interviewed, 113, is larger than

Table 3**Age and sex of children interviewed from 1988 to 1991**

Age of children in years	Number of girls	Number of boys	Total
3 - 4	1	0	1
4 - 5	3	1	4
5 - 6	8	12	20
6 - 7	15	13	28
7 - 8	29	25	54
8 - 9	17	19	36
9 - 10	23	16	39
10 - 11	10	8	18
11 - 12	3	3	6
12 - 12.04	4	2	6
Total number of children	<u>113</u>	<u>99</u>	<u>212</u>

the corresponding number of boys, 99. In any one age group, however, there is little difference in the numbers of either sex.

3.5.4 Interviews with children

As the interviews were to be carried out by teachers in very different schools and with pupils of different ages, it was necessary to provide a structured framework. The interview structure had to:

- * provide a framework which would enable results to be analysed and ensure comparability but which would not hinder more extended discussion with children,
- * be amenable for use by teachers with varied interests and experience,
- * take account of the constraints under which teachers operate; these include time and the availability of quiet areas in which to work with individual children,
- * provide appropriate activities for use with pupils from five to twelve years,
- * recognize the varying abilities and needs of children from culturally diverse backgrounds.

The interviews were not intended to provide a way of assessing pupils and it was essential that the children being interviewed did not feel that the activities were a 'test'.

3.5.5 The Pilot Study

In 1987 the author spent five days between January and June in a middle school in Harrow interviewing children in two classes, one a first year class of 8-9 years (Year 4) and the second a fourth year of 11-12 years (Year 7). The aim was threefold. First, to discover more about the understandings which children had about food, including why and how they made food choices, how they grouped foods and what values they attached to particular foods. Secondly, to explore the practicalities of developing a semi-structured interview procedure which teachers could use in their own classrooms with children of different ages. Thirdly, to alert teachers to the range and types of responses which children might give in answer to questions about food.

The visits to the school took place in January, March and June 1987. On all three visits children of eleven to twelve years (Year 7) were interviewed and in addition, in June, six children from one class of eight to nine years (Year 4). The Year 7 class was chosen because they were to commence a food based topic in January; also the class teacher had completed the Diploma in Primary Science Education course the year before and was aware of the purposes of the activity. The series of interviews in January, March and June enabled the author to work with groups of children at the beginning, during and after the completion of their work on food. The teaching plan for the topic is shown in the diagrammatic 'topic web' in

Figure 31. It was not intended that all aspects of the topic outlined in the plan should be covered in one term. One function of the diagram was to indicate how links could be made between different areas of the curriculum. The topic was planned as an interdisciplinary one which would include historical and geographical elements as well as science. In science, aspects of taste, particularly sweet and sour, were to be investigated, as well as the changes which occur during the cooking of food. During the term the food topic deviated from the teacher's original plan; the underlined sections shown in Figure 31 are those which were actually taught between January and March 1987. Cooking utensils, their use in history and throughout the world were studied. Surveys of what children ate were undertaken by the class and also by other classes in the school during the term; the results of the surveys had been linked to discussion about diet and health and what factors govern food choice.

During the initial interviews in January 1987 sixteen children were interviewed in groups of four. After discussion with the class teacher it was decided to form groups comprising two girls and two boys, the groups being selected by the teacher. The interviews took place in the library; this meant that it was possible to talk to the group informally and without interruptions from the rest of the class. On this occasion the author spent thirty minutes with each group. Each group undertook four activities and the discussion was tape recorded. The timing of the sessions was influenced by the need to work within the

Figure 30

Examples of pictures of food used in interviews
1987 to 1991

5



6



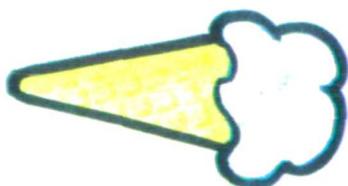
8



19



23



27

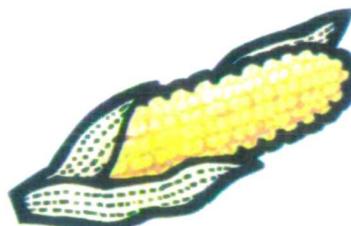
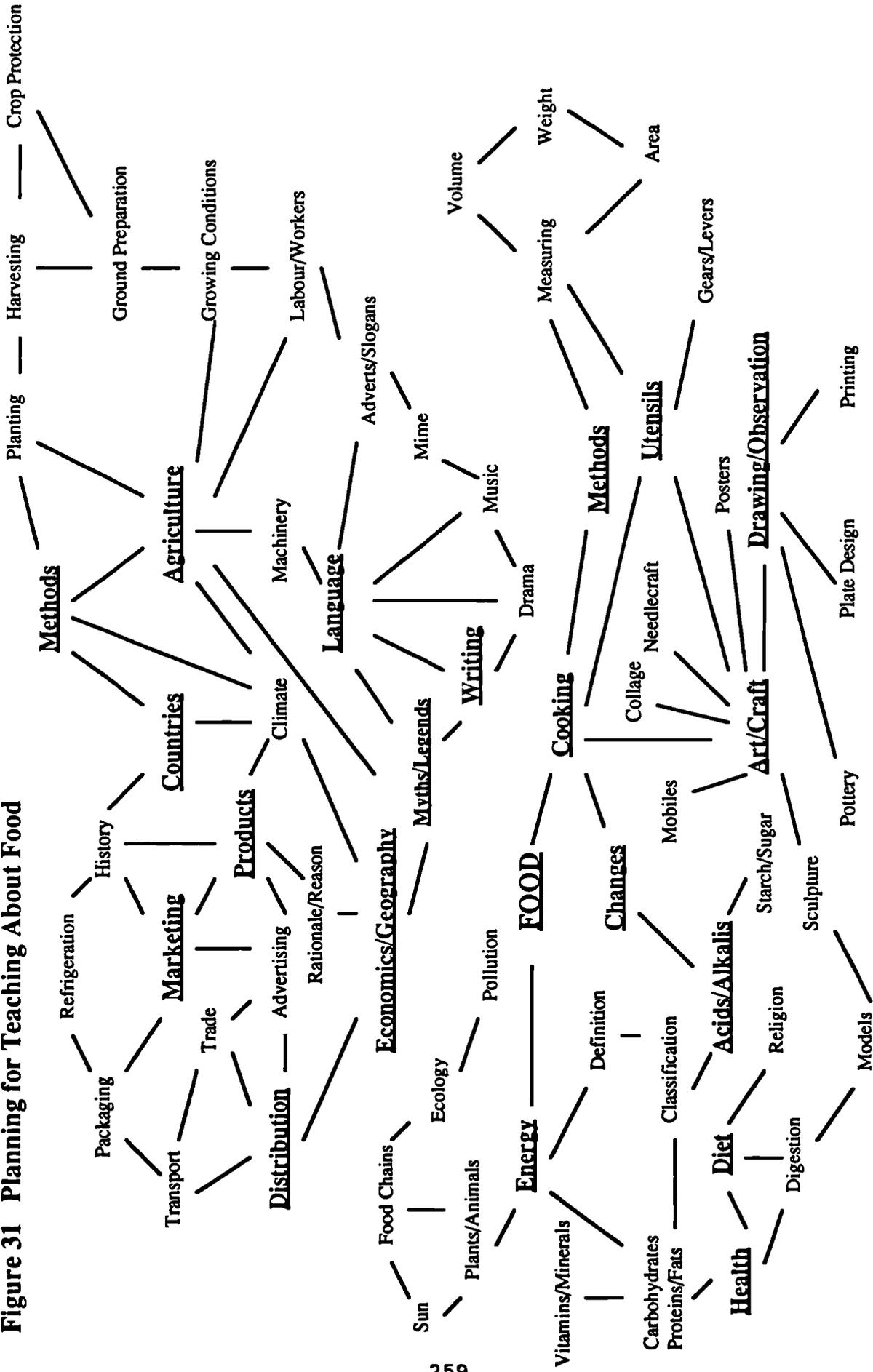


Figure 31 Planning for Teaching About Food



constraints of the normal school day and to demonstrate that small group discussion for a limited period could yield sufficient valid information about children's ideas.

These preliminary interviews drew on the author's personal experience of working with children in classroom situations over a period of years, as well as evidence from reports on research discussed in Chapter II which utilized what have been termed 'interviews about instances' (Gilbert, Osborne and Fensham, 1982). Cards with pictures were a means of stimulating discussion and elucidating children's ideas which had been used successfully in other contexts (for example (Bell, 1981a; Bell 1981b) and in studies of how children grouped food (Holland, 1981). Simple pictures of individual foods were identified as a useful way of initiating discussion and probing children's understanding. A selection of outline pictures of different foods was used in these interviews; examples are shown in Figure 30. Children were asked to group the pictures of food in any way they wanted, to select meals, using the cards if they wanted, and encouraged to talk about their reasons for making these choices. Cards with the names of nutrients, including vitamins, sugar, protein and fat were used to probe children's understanding of nutrients.

The structure of the activities in these preliminary interviews was as follows:

Activity 1

The children were given fifty cards (6 x 4 cm). The pictures were coloured but the foods were drawn in

outline with little detail, as is shown in Figure 30. The children were asked to go through the cards and to say what each represented. Any cards which they did not recognize were put to one side. This activity was designed to be one which the children could accomplish with ease; it served the dual function of an 'icebreaker' with children whom the author did not know and as a means of demonstrating that what we were doing was fun as opposed to a test situation. The question 'What do you think food is?' was posed towards the end of the activity.

Activity 2

The children were asked if they could put the foods into groups. The activity was an open ended one and they were given complete freedom to group the cards as they wanted. It was suggested that any cards they could not group initially should be put to one side and looked at again later. Questions such as 'Can you explain why you put these cards together?' were asked if the children did not proffer explanations for their groupings.

Activity 3

The children were asked to use the cards to select foods for three meals, breakfast, lunch and tea/supper, plus snacks. They were invited to create more cards if items they would like were not shown on the cards. It was also suggested that they could use

one card for more than one meal or snack.

Activity 4

Children were shown a series of eight cards each of which had the name of one nutrient written on it: carbohydrate, fat, fibre, minerals, protein, starch, sugar, vitamins.

The cards were introduced by the author explaining that she was going to show them some cards with words which they might recognize but that they might not have heard them before. If children recognized the word they were then asked if they knew what the substance was and if they could give any examples of foods which contained that substance. The order in which the cards were used varied; words which had been used by the group during earlier in the discussion were used first or words like sugar with which individuals were more likely to be familiar. It was recognized that the order in which the words shown to the group could have affected the type of answers obtained but the need to maintain the dialogue with the group, and to prevent individuals feeling that they were being 'tested', was considered to be of greater importance than using a predetermined sequence.

In March 1987 the author interviewed all twenty-four children in the class, the groups were the same as in

January but two of the original groups of four were split into pairs. The original groups of four had been selected as being compatible but in one group individuals had tended to dominate the discussion so it was decided to split this group further. Timetabling for physical education also meant that it was necessary to split a further group. Eight children not interviewed in January, because of time constraints or absence, were also interviewed in groups of four. The interviews followed the same pattern as in January; however a twenty-four hour recall was added to see whether the food choices made by the groups were similar to those made by individuals.

The visit to the school in June 1987 was designed to find out what changes had taken place in the children's thinking about food since the interviews in March. Although no formal teaching about food had been planned with the Year 7 children for the summer term all of the class had done some meal planning and cooking. Some children had also chosen the topic of food as the basis for their individual projects in the summer term. Unforeseen timetable alterations on the day of the visit meant that it was only possible to interview six children from the original class. A further eight children from a Year 4 class (eight to nine years) were interviewed to find out what changes, if any, were needed to the interview structure for use with younger children.

These initial interviews indicated that using cards as a means of initiating discussion and to help structure an interview with children could be developed into a framework

for teachers to use. In the early stages the author had worked with groups of children. This strategy was employed as children and interviewer were strangers, but the interviews in March and June were with pairs or with individual pupils. These tape recorded interviews indicated that one to one, as well as small group, interviews of the type envisaged were a useful way of learning more about children's ideas about food. On the basis of these interviews it was decided that thirty cards was the maximum that could be used with younger pupils. Each interview took about thirty minutes; this was considered the maximum length of time which it was appropriate for children to spend on the activities.

3.5.6 Trials of interviewing procedure

The findings from the preliminary interviews undertaken by the author in 1987 were used to develop an outline framework for teachers to use with children which centred around the use of cards with pictures of food (examples are shown in Figure 30). Although the original pictures used by the author had been in colour, black and white photocopies had to be used in the trial for reasons of economy.

Teachers on the 35-day Coordinators and Diploma courses in 1987/88 were invited to participate in the research programme during teaching sessions at the Institute of Education in December 1987; those who expressed interest in the project were also written to, the

letter of invitation forms part of Appendix V. The interview procedure was trialled subsequently by twelve primary teachers during the period from December 1987 to February 1988. The background information and the forms used for recording their findings form Appendices V and VI. Prior to the work in schools the author talked through the purposes of the activity with the teachers concerned and discussed ways in which the interviews could be structured and organised. The teachers were encouraged to comment critically on the interviews, the procedures used and the report sheets.

Eleven of the teachers interviewed up to five children on an individual basis. One teacher and a colleague interviewed children in their classes either individually or in small groups. The age and sex of the thirty-two children interviewed for whom record sheets were completed are shown in Table 4; from this table it can be seen that the majority of children were aged from 8 to 11 years and that the ratio of girls to boys was 3:1.

The discussions with pupils centred around three activities, two of which involved the pictures of food which were mounted individually on card to make them easier to handle. Children were shown the cards, invited to handle them and encouraged to talk about the foods. Any foods which they did not recognise were put to one side; the name given to the food by the child was accepted - many children, for example, interpreted the picture of a bread roll as a hamburger. A maximum of thirty cards was used; the pictures included a range of foods, including fruit and

Table 4**Age and sex of children interviewed in trials 1987/88**

Age of children in years	Number of girls	Number of boys	Total
5 - 6	2	0	2
6 - 7	1	1	2
7 - 8	0	0	0
8 - 9	5	3	8
9 - 10	12	4	16
10 - 11	4	0	4
Total number of children	24	8	32

vegetables, cereals, pulses, meat and dairy produce (shown in Table 5). Although the choice of pictures used was based upon those which had been most commonly selected in the preliminary interviews the foods depicted were chosen also to reflect the multicultural nature of the classes in which the interviews were taking place. The cards were numbered from 1 to 30 (as shown in Appendix V) to help teachers to record the results more easily; the cards were numbered randomly so that the association between foods depicted on consecutively numbered cards was minimised.

In the first activity children were asked to group the pictures of food as they wanted. Work with teachers in these trials confirmed that thirty cards was a suitable number to use with pupils from 8 to 11 years although twenty was more appropriate for children aged five and six years. The children were then asked to select foods for meals. Although they could use the cards if they wished, they were invited to suggest other food items. In the third activity cards with the names of nutrients (listed in Table 6) were used to probe children's understanding of common nutrient terms.

Teachers were asked to record their findings using record sheets (shown in Appendix VI); they were also invited to comment on the activities and the method of recording. As a result of these comments some changes were made to the report sheets to make them easier to use, for example tabulation of the sheets. The pictures of food were numbered so that teachers could record food groups and choices more quickly. No headings were used in the columns

Table 5

Foods depicted on cards used in food grouping and food choice activities 1988 to 1991

banana	jam
beans	jelly
biscuit	
bread	lettuce/cabbage
cake	margarine
carrots	milk
cereal	
cheese	nuts
chicken	
chips	oil/sauce
cola	
corn on the cob	potato
crisps	
	rice
egg	roll/bun
fish	strawberries
	sweets
icecream	
	tomato

Table 6

**List of nutrient and related terms used in interviews
1987 to 1991**

fat
fibre
protein
minerals
salt #
sugar
vitamins
carbohydrate *
starch *

not used in pilot or trials 1987/88

* terms introduced only where considered appropriate by
teachers

for food choices as these served to constrain recording of groups that children themselves might use. Salt was also added to the list of nutrients as there were indications both from this trial study and the earlier interviews by the author that salt and sugar were being linked together by some children.

3.5.7 Interviews with children 1988 - 1991

In 1988/89 the interviews about food became an integral part of the course for both the Diploma in Primary Science Education and the course for Co-ordinators for Science in Primary Schools as outlined in section 3.5.1.

One session of the course was devoted to preparation for the interviews. In the introductory period participants completed a questionnaire (shown in Appendix IX) which explored their own understanding of issues related to food, diet and health and which asked about strategies which they used for teaching about food. The questionnaires were used as a basis for discussion which focussed on the nature of children's ideas in science, work by Osborne and Freyberg (1985) being used as background reading for these discussions. The nature of participant research was discussed in relation to the work they were to undertake.

In the second part of this session participants worked in pairs trialling the materials they would use with children (shown in Appendices VII and VIII) and taping their responses and discussion. The tape recordings were

used to identify significant points in the discussion and to initiate wider whole group discussion about the purpose and structure of the interviews, including the importance of standardisation of the interview procedures used to allow comparisons to be made. Questioning strategies were also discussed; this discussion included consideration of language use and non-verbal 'clues'. The group then considered implementation of interview procedures with children, including the importance of the interviews taking place in as relaxed a manner as possible and of ensuring that the child did not feel 'threatened' or in a 'test' situation. The interviews were viewed as a time for children to have a chance to talk and to explore ideas with their teacher in a way rarely possible in most schools.

The duplicated pictures of food and the nutrient terms were cut up and mounted on card. As cost precluded the use of coloured photocopies the pictures were sometimes coloured by teachers (or children); lack of colour had not been shown to be a factor in food groupings in the trials so colouring was not regarded as essential. Ensuring that the card used for mounting was the same colour was important, however, as the trials had indicated that younger children might group the pictures using this characteristic.

3.6 Interview framework 1988 - 1991

The framework for the interviews used from 1988 onwards consisted of three elements or activities related to food grouping, food choice and knowledge of nutrients, together with ascertaining the child's views on the need to eat food.

Thirty cards with pictures of foods, which are listed alphabetically in Table 5, were used to stimulate discussion and as a basis for the work on food grouping and food choices. The selection of foods remained the same as that used in the trials in 1987/1988. It included a wide range of foods and food products which earlier work in the pilot and trials (see section 3.5) had indicated children identified readily. The purpose was to enable the child to be able to use the cards as a basis for grouping foods and for choosing foods that they could eat.

The activities undertaken in the interviews were:

Activity 1 Food grouping

After becoming familiar with the cards the child was asked to place them into groups. The reason for the groupings were elicited by teachers asking:-

"Can you tell me why you have put these foods together?"

Any grouping system that the child used was acceptable. Teachers were asked to record the groups used and the items assigned to each group.

Activity 2 Food choice

Children were asked to select foods for breakfast, lunch, tea/supper plus snacks. The cards were used as a basis for the selection although the children were told that they could choose additional foods or drinks if they wanted. They were also allowed to use each card more than once, for example, oranges could feature in foods chosen for breakfast as well as lunch.

Again, teachers were asked to record items children chose and any reasons that they gave for choosing these foods. Space was provided on the record forms (which are shown in Appendix VIII) for any additional comments by children and/or teachers.

Activity 3 Knowledge of nutrients

Cards with the names of nutrients, listed in Table 6 and shown in Appendix VII, were shown to the children who were then asked a series of questions about the word on the card:-

1. "This word saysCan you tell me if you have heard (or seen) this word before?"
2. "Can you tell me what you think is?"
3. "Can you tell me the names of any foods which you think have in them?"

The order in which the cards were shown to the children varied; it was suggested that teachers start with words which children had used spontaneously in earlier activities. The pictures of foods could also

be utilized to ask:-

"Can you see any foods here which have ... in them?"

Earlier trials had indicated that words such as carbohydrate and starch were rarely recognised by pupils below the age of nine years and it was suggested that teachers should only use these cards with younger children if they felt it was appropriate to do so.

Teachers recorded responses, including explanations given by children about the nutrients and examples of which foods contained particular nutrients, on the record sheets shown in Appendix VIII.

The question:-

"Can you tell me why you think that we need food?" was posed at the end of the session if the child had not already suggested a reason for eating during the course of the interview.

Space was provided on the record sheets for any additional comments made by children which teachers regarded as significant or interesting. Teachers were encouraged to use the space for any additional comments on the interview procedure which had been identified during the interview.

3.7 Teachers' reports on interviews

Teachers reported on the interviews with children in two ways:

1. Through group and individual discussions with the author and other course members;
2. Through written reports.

Opportunities for discussion were provided both formally, through the planned programme, which is summarized in Figure 28, where a two/three hour session was allocated for reporting back, through individual tutorials, and informally. The discussions permitted teachers to share their findings, to ask questions about the activities and to clarify their ideas and to extend their thinking.

For many teachers the written report on the interviews was the first writing which they had undertaken for many years and consequently they were often tentative. The task was made easier by encouraging teachers to use the forms which they had used during the interviews to structure their reports; additional detail about their findings was provided from edited transcripts of the recordings made during the interviews. Their own reflections on what they had learnt from the activities and discussion of the implications of these for teaching followed naturally from writing about their findings. From 1989 onwards the summary report written by the author which was based on the findings of teachers in 1988/89 (Appendix IV) was used to stimulate discussion and to provide background reading.

The importance of reflective writing as an aid to learning and professional development is widely recognised,

as is indicated by Walker (1985). Written reports on school based assignments can lead to a number of important outcomes which were identified by Frost and Turner in their review of the Co-ordinators course at the Institute of Education (Frost and Turner, 1987). They include the increase in confidence exhibited by teachers and their ability to evaluate their teaching. Frost and Turner suggest that the opportunity to reflect upon practice which is provided through reports on school based activities, both oral and written, is an important mechanism for learning and personal development.

3.8 Planning for teaching

If the results from the interviews with children were to have any affect on curriculum development it was important that they were not viewed as isolated from the rest of the INSET programme. Their importance had to be acknowledged and insights gained had to be used both to inform and to develop teaching strategies. The implications for teaching identified by teachers in their reports had to be recognised and discussed further. Information gained from the interviews was incorporated therefore into the programme of work which students undertook at the Institute. There were various elements in the programme where work on food and health could be included:

1. Planning cross curricular topics or topics where science or health were the main focus, in particular those related to food and diet; such

- planning should include identification of the personal, social, economic aspects of food choice in the context of the multicultural school;
2. Consideration of the role of the teacher as manager of the learning environment, for example in the organisation and use of resources, in planning whole class or group activities, methods of recording used by children;
 3. Developing contexts for assessment and monitoring of children's progress;
 4. Development of school policies for science;
 5. Teaching in and for a multicultural society;
 6. Updating and extending the scientific knowledge of members of the group to increase their confidence when teaching science based topics.

The ways in which the results of the interviews were related to later parts of the course are indicated in Figure 29. Teachers did not necessarily teach food related topics but what they had learnt could be used to inform their teaching in a number of ways. The reports on teaching which they wrote later in the course were used to monitor the extent to which teachers were using and developing ideas from the interviews with pupils in their teaching and in the monitoring of pupils' progress.

The other contexts identified above were also used as a means of extending the understandings gained concerning children's ideas about food.

3.9 Teachers' ideas about food

The questionnaire which was used to evaluate teachers' own ideas about food and diet prior to the interviews with children is shown in Appendix IX. The intention was that the questionnaire should provide a means of focussing discussion on issues related to food and diet and provide teachers with a means of exploring and developing their own ideas without feeling threatened. The questions which teachers asked provided an ideal vehicle for promoting discussion allied to investigations which helped to clarify understandings and misconceptions.

The second part of the questionnaire focussed on ideas for teaching; the purpose was to provide a starting point for considering approaches to teaching about food and nutrition.

3.10 Innovations in methodology with respect to nutrition education

Interviews with children which have explored their ideas about food has been undertaken before , for example the research discussed in Chapter II by Contento (1981), Newsome (1983) and Magarey et al (1986). The scope and purpose of such interviews, however, have been different from the present study. Teachers have also interviewed children to elicit ideas about their understanding of science concepts, for example the work recorded by Osborne and Freyberg in New Zealand (Osborne and Freyberg, 1985).

The study outlined in this chapter differs from earlier work in a number of respects:

1. The use of individual interviews with children by teachers which is linked to teachers' reflective writing and analysis of these interviews;
2. The use of interviews and reflective writing to develop teachers' understanding of:
 - a. children's ideas about food and health,
 - b. their own understanding of food and health,
 - c. ways of assessing and monitoring children's progress in science.

The way in which the results of the study are being used can also be considered as innovative. These uses include the opportunities provided for teachers to use information derived from such interviews as a means of developing:

1. Innovative practice which will facilitate children's learning, for example by giving pupils greater autonomy in planning activities, and curriculum change in specific areas of the curriculum;
2. The planning of cross curricular topics which include study of food and health and which involve the identification of the personal, social and economic aspects of food choice in the context of the multicultural school;
3. Developing strategies for assessment and monitoring pupils' progress;
4. Evaluation of the role of the teacher as manager

of the learning environment in ways consistent with those outlined by, for example the Plowden Report (DES, 1967), and as a reflective practitioner (Schon, 1987).

A further important element of reflection on practice which is identified above is the diaries kept by co-ordinators on their coordination role during the year. Walker (1985) identifies such reflection as a means of providing opportunities for professional growth and development.

3.11 Summary

This chapter has considered the context of the research study as a component of in-service courses in science education for primary teachers. The background to the research and the methodology chosen have been outlined.

The development and implementation of the interview structure which teachers used with children to elucidate their ideas about food has been described, including the pilot study by the author and the trials in schools prior to the main study. In the following chapters the outcomes from the study will be analysed in detail. Chapter IV examines what was found out about children's ideas about food and nutrition from the interviews. In Chapter V the author considers the implications of the findings for teachers, curriculum development and policies for nutrition education at school and national level.

CHAPTER IV

Exploring children's ideas about food and health

4.1. Introduction

The purpose and structure of the interviews which primary teachers carried out as part of their courses in science education at the Institute of Education were described in the previous chapter. In this chapter the findings from these interviews, including the pilot and trials in 1987/88, will be considered in detail.

Teachers reported on the interviews orally and in written reports which incorporated report forms for each child and edited transcripts of the interviews. The report forms and transcripts provided data concerning children's ideas about four areas of knowledge and understanding in relation to food and nutrition:

- food groupings
- food choice
- knowledge of nutrients
- reasons for eating

Further qualitative information about children's ideas came from the reports written by teachers, which included analysis of their findings. The reports provided additional information about children's ideas in relation to the four areas identified above which were not covered in the report sheets, for example issues of language use by children for whom English was a second language.

The main focus of the teachers' written reports was the interviews with children and their findings. The reports also contained an analysis of results in which the most important feature related to children's understanding. The discussion of the children's knowledge and understanding can be separated into that which deals with knowledge and understanding related specifically to food and diet (discussed in Section 4.10) and that which covers more general issues allied to skills (considered in Section 4.11).

One purpose of the research was to provide opportunities for teachers to reflect on their own knowledge and understanding about food and health and on approaches to teaching. The importance of these areas was stressed in Chapter III both in the context of the requirements of the courses and of the need to help teachers to develop professionally. The pre-course questionnaires which teachers completed provided data on teachers' ideas about specific areas of food and health which are discussed in Section 4.12. The questionnaires also provided information about teaching strategies which will be examined in Chapter V.

The chapter begins by considering the findings from the Pilot and Trial studies in 1987 and 1988 before looking in more detail at the results from the interviews with teachers from 1988 to 1991. It concludes by considering aspects of teachers' understanding about diet and health.

4.2 Sources of information about children's ideas

The three phases of the study comprised:

1. Pilot study 1987;
2. Trials by teachers 1987/1988;
3. Interviews as part of primary courses for teachers 1988/1991.

In all three phases information about children's ideas was collected by means of tape recordings and record sheets completed during the interviews and from additional notes made both during and immediately following the interviews.

4.2.1 The pilot study 1987

The nature and methodology of the pilot study were described in Chapter III, Section 3.5.4. Although the interviews described there provided information about children's understanding the major purpose was to identify a framework for interviews to be carried out by teachers from 1988 onwards.

4.2.2 Trials of interview procedures by teachers 1987 to 1988

In December 1988 twelve teachers from the Diploma in Primary Science Education and the 35-day Coordinators for Primary Science courses volunteered to interview a small number of children in their classes. Only five teachers returned report forms, others interviewed groups or

individual children and reported verbally on their findings. Data from interviews with thirty-two children aged between five and eleven years were collected; the age and sex of these children is indicated in Table 4.

A major purpose of the interviews was to trial the interview and recording procedures to discover how they should be modified for use by teachers in 1988/89. Although information about children's ideas was obtained from the completed record sheets, the results have not been included in the overall analysis of the data obtained from interviews from 1988 to 1991 as the purpose and the data collection in the trials was different. Observations on patterns which are consistent with later work are included.

One enterprising teacher who interviewed fifteen children, subsequently asked all the children in her school aged from six to eleven years to write down why they thought we ate food. The responses are of interest and provide additional information which is relevant to the main study.

4.2.3 Interviews 1988 to 1991

The numbers of teachers on the Diploma in Primary Science Education and 35-day and 20-day Coordinators in Primary Science courses who interviewed children between 1988 and 1991 and submitted reports is shown in Table 1. A total of seventy teachers completed reports. A further ten teachers interviewed children but did not complete coursework reports for a variety of reasons. These

teachers reported orally but as report forms were not received the information is not included in the analysis which follows.

Each teacher was asked to interview three children. However, some teachers interviewed additional children, usually because they found the results from the first three interviews were unexpected or intriguing. Thus the total number of children interviewed, as shown in Table 2, is slightly greater than might be expected from the numbers of teachers involved. The analysis of the numbers and sex of children in each age group is shown in Table 3. From this table it can be seen that although the majority of children were aged from five to eleven years there were a few children who were either younger or older. Some teachers worked with nursery classes and wished to try the activities with children with whom they worked. Information about the six pupils aged twelve years or above came from two teachers, one of whom was working in a middle school and one with lower secondary pupils. The total number of children interviewed in any one age group is relatively small and thus the data from the interviews provide information only about trends and patterns in that sample population. Although the results cannot be regarded as statistically significant they provide valuable insights into the ideas held by children of different ages and a starting point for future research.

The main source of information and data about children's ideas came from tape recordings, edited transcripts and record sheets completed by teachers.

Additional information came from notes made by teachers during and immediately following the interviews with children. Further information came from discussions with teachers and the author. To ensure confidentiality teachers used children's first names or a coded letter for each child interviewed.

The data were analysed by means of a database management system which permitted quantitative and qualitative data to be stored and analysed. Report forms from each child were assigned a number and teachers given a code to assure anonymity.

4.3 Findings from the Pilot Study in 1987

Data from the pilot study interviews were collected by means of tape recordings and notes made during the interviews. The pilot study aims, which were discussed in Chapter III, were to investigate the range of ideas held by pupils and to develop an interview structure for teachers to use.

As the number of individuals interviewed in the pilot study was small the data cannot be regarded as being significant; its main value lies in the information which it yielded about the range of ideas which these children had about food and health and the evaluation of the interview procedure. The findings from the interviews with eleven and twelve year olds will be considered in terms of the three main activities, namely grouping of foods, food choice and understandings about nutrients.

None of the pupils interviewed had any difficulty in recognizing the pictures of foods on the cards, even items such as peppers (capsicums) posed no problems. Occasionally children suggested acceptable alternatives to the food shown in the outline drawings, for example one group identified brown bread as cake.

4.3.1 Food grouping activity

This activity resulted in much discussion in the groups. The nature of the discussion and the resultant food groupings depended not just on the knowledge which pupils had but on group dynamics. More dominant members tended to impose their ideas, which sometimes required later revision, and quieter members had to be encouraged to express their views.

The final, negotiated groupings used by pupils in January and March 1987 are shown in Tables 7 and 8. Children in Groups V and VI were not interviewed in January. As can be seen all groups used some form of classification scheme of the type categorised by Holland (1981), which was discussed in Chapter II, as context independent. All the children placed fruit and vegetables in separate groups; these were generally the first foods to be placed in groups. Meat, normally with fish, also formed a readily identifiable grouping; Group V considered that seafoods were difficult to classify. Sweet things were also classified separately. Group I included crisps in their sweet group not because they thought that crisps were

Table 7**Food groups used by pupils in Pilot Study January 1987**

Children	Fruit	Veg.	Meat + fish	Sweet	Additional groupings
Group I	yes	yes	yes	yes	Natural products e.g. fruit and vegetables Liquids e.g. oil, drinks Healthy foods e.g. bread, yogurt, cheese, cereals, eggs, butter/margarine
Group II	yes	yes	yes	yes	Milk/ Milk products e.g. yogurt, milk Nuts
Group III	yes	yes	yes	yes	Drinks Rubbish foods e.g. coke Biscuits and cakes Cereals Nuts
Group IV	yes	yes	yes	yes	Dairy products e.g. milk, yogurt Wheat and bread includes breakfast cereals

Table 8

Food groups used by pupils in Pilot Study March 1987

	Fruit	Veg.	Meat + fish	Sweet	Farm/dairy	Additional groupings
Group I	yes	yes	yes	yes	no	Fats, Carbohydrates Protein (inc. some fruits)
Group II	yes	yes	yes	yes	yes	Factory products
Group III (a)	yes	yes	yes	yes	yes	Oily foods e.g. crisps, chips
Group III (b)	yes	yes	yes	yes	yes	Snacks e.g. crisps, chips, peanut butter Eggs
Group IV (a)	yes	yes	yes	yes	no	Snacks e.g. biscuits, coke, sweets Fattening e.g. cake, ice cream, chips, crisps
Group IV (b)	yes	yes	yes	yes	yes	Oily foods e.g. chips Nuts, Wholemeal
Group V	yes	yes	yes	yes	no	Protein e.g. meat, nuts, chicken Fat/carbohydrate e.g. bread, cereal, pots.
Group VI	yes	yes	yes	yes	yes	Mixed group = foods not grouped elsewhere e.g. nuts, ham oil, bread

sweet but because they were regarded as 'unhealthy' foods. The idea that sweet things were bad for you, although regarded as what one pupil charmingly described as 'delights', was frequently mentioned. 'Coke' was always described being 'bad for you', one group described it as a "rubbish food", but not always because it was sweet. Nuts were always identified as separate items and placed in groups only after much discussion. In addition to these groupings each group of children also identified further categories and these are of interest in terms of the differences between those used in January and March.

The basic fruit and vegetable and meat categories defined in January were still being used in March. The additional groupings used by pupils in March at the end of their food topic, however, were more sophisticated and complex. Three groups of children defined a fifth category, dairy/farm products which reflected teaching which had taken place about sources of food. Four groups identified fats or oily foods as a separate category. Groups I and V both suggested proteins, carbohydrates and fat as possible groupings after they had placed the foods into the first four categories shown in Table 8. This finding was of particular interest as the class had not been formally taught about nutrients, although the class teacher had discussed aspects of nutrient groups based on chemical structures with individual children in response to questions. From the discussion with Group I and V it was apparent that the children were having to reconcile the nutrient grouping with their earlier method of

classification. It was clear also that there were misunderstandings about what was meant by terms like carbohydrate and protein. Group I decided that proteins included fruits. Group V decided that fats and carbohydrates formed one group which included potatoes "although they are vegetables". Some of the children in these two groups were evidently on the threshold of understanding what was meant by terms such as protein and being able to use this knowledge in ways described by Barnes (1976) as 'action knowledge'.

The Year 4 children also placed fruit and vegetables and 'sweet' foods in discrete groups; the other groups which they used were less consistent. In most cases foods were placed in groups which went together, for example chicken and egg, or which were associated with meals, for example milk and cereal.

4.3.2. Meal and snack choices

Perhaps the most valuable part of this activity was the discussion, which revealed a great deal about the pupils' understandings about why certain foods should be eaten. The foods chosen by the groups are listed in Tables 9 and 10; only Groups III and IV were interviewed in both January and March. The final choices were based on a consensus view, they did not necessarily reflect what individual children ate, or said they ate, for those meals, although the results were similar to those obtained from the twenty-four hour recall sheets which the pupils

Table 9

Meal choices made by children in pilot study January 1987

	Breakfast	Lunch	Tea/supper	Snacks
Group I	Cereal, Bread, Egg (if not fried) Bacon Milk	Pie or Roll + peanut butter Biscuits, Coke	Fish or sausages + chips, Cabbage or beans, Jelly or yogurt	Cheese sandwich, Drink e.g. tea, Nuts
Group II	Cereal, Bread + butter, Bacon, egg Milk or tea	Sausages or hamburger Potatoes - chips or jacket, Beans or peas or carrots, Ice cream, Biscuits, Milk	Meat e.g. chicken, Potatoes or rice, Drink e.g. milk or coke	Biscuits Drink e.g. tea
Group III	Cereal, Toast + butter + jam, Bacon, egg sausage, Yogurt, Milk	Fish or meat + rice Or bread and cheese Or burger, Vegetables Fruit	Pie e.g Cornish pasty or meat e.g. pork or chicken, Carrots, Salad Fruit or pudding or cake	Bread, Cake
Group IV	Cereal, Bread or toast + jam or peanut butter, Bacon, egg, sausage, Milk	Hamburger, sausage, egg Yogurt or ice cream	Chicken or pie or crab (special occasions) Vegetables e.g. carrots, potatoes, beans, Salad Yogurt, fruit, jelly, ice cream	Bread + butter + jam, Crisps, Peanuts, Drink e.g. tea

Table 10

Meal choices made by children in pilot study March 1987

	Breakfast	Lunch	Tea/supper	Snacks
Group I	-	-	-	-
Group II	-	-	-	-
Group III (a)	Toast Bacon + eggs Drink	Salad - sweetcorn, tomatoes, cucumber, nuts, mushrooms	Fish + chips Roll/bun Milk	Crisps, chocolate, coke
Group III (b)	Cereal, Sausage, egg, bacon Toast + butter Yogurt	Hamburger, chips Fruit e.g. orange, banana Drink	Meat or fish, carrots, beans, jelly	Biscuits, ice cream coke
Group IV (a)	Cereal, Bread + butter Egg, cheese Milk	Meat, Cornish pasty Fruit	Meat or fish Rice or chips Vegetables Dessert	Biscuits, Sweets, Cola
Group IV (b)	Cereal, Bread, tea	Pizza, Salad, Chips	Chicken, pie, sausages, Vegetables Chips Cake/sweet Fruit	Sandwich Coke,
Group V	Cereal, eggs, toast + butter or margarine	Sandwich	Roast meat (weekend) Omelette (weekday) or rice, Chapatti, meat + vegetables	-
Group VI	Bacon, egg Bread Milk	Hamburger, chips, vegetable e.g. sweet -corn Cake	Fish, Salad, Bread, Jelly	Cake, Sweets, Nuts

completed on the same day. The choices for lunch were often influenced by the types of food available for school lunches. The idea of a meal being something with meat or fish plus vegetables followed by pudding or fruit was universal. What is striking about all the food choices is that they indicate both variety and balance in the context of a range of foods which provides the nutrients required for maintaining health.

Groups I and III in particular talked about 'healthy foods' and this governed their choices, at least in part. For example, Group I suggested that an egg for breakfast was acceptable if it was not fried. Healthy foods included brown bread, cereals, dairy products and fruit and vegetables. Despite the frequency with which vegetables were described as healthy they tended to be added to the list of foods chosen for meals as an afterthought. Where salad was mentioned, for example Groups III and IV, it was because it was "good for you". The list of vegetables which would not be eaten by individuals was a long one!

As Tables 9 and 10 indicate there were few differences between the meal choices in January and March. Salads continued to feature as part of either lunch or supper for Groups III and IV.

Year 4 pupils also chose foods which they would normally eat and which were liked and which were similar to those listed in Tables 9 and 10.

4.3.3. What are nutrients?

In this pilot study questions were asked about the nutrients listed in Table 6. The list was the same as that used in later interviews but no questions were asked about salt; salt was added to the list in subsequent interviews as a result of the discussions noted above about the inclusion of crisps in a group of foods categorised as sweet. As was indicated in Chapter III, Groups I to III were asked questions about nutrients in January 1987 and all six groups were interviewed in March 1987; the results are summarized in Tables 11 and 12. A small number of individuals was also interviewed informally in June 1987.

In January each of the terms was familiar to at least one child in each of Groups I to III. In most cases the groups were able to generate lists of foods containing particular nutrients but were unable to explain what the terms meant. The idea that vitamins and fibre were linked to health was common to all three groups, as was the idea that vitamins were tablets. Although some children remembered learning about nutrients in school the previous year very little of what they had learnt was recalled. Where terms such as carbohydrates were mentioned spontaneously children admitted that they "were not sure what these were".

The responses which children gave in March were more detailed and indicated greater understanding; this finding was consistent with the observations made for the food grouping activity. All six groups were able to say

Table 11

Pilot study January 1987 - Children's ideas about nutrients

n = 12 (3 groups of four children)

	Word recognised	Explanation and reasons for eating	Examples
Carbohydrate	yes	none given	Group I: carrots, Group III: potatoes, rice, bread, wheat, milk
Fat	yes	none given	All groups: chips, bacon, meat, fish, lard oil
Fibre	yes	Groups I and II - associated with digestion of food and health	All groups: Brown bread, muesli and other cereals Group II: potato skins
Minerals	yes	Group I - seen down microscope Group II - found in water and foods	Groups I and II: mineral water
Protein	yes	none given - one group associated word with vitamins	All groups: milk and milk products e.g. cheese
Starch	yes	Two groups thought it turned to sugar	Group I: potatoes, Group II: carrots
Sugar	yes	Associated with sweet tasting foods; bad for teeth	All groups: sweets, cakes, fruit, biscuits, cereals, tinned food e.g. fruit, baked beans
Vitamins	yes	Tablets; needed for health. Different vitamins e.g. A, B, C, D	All groups: tablets, fruit vegetables, fruit juice,

Table 12

Pilot study March 1987 - Children's ideas about nutrients

n = 24 (6 groups of four children)

	Word recognised	Explanation and reasons for eating	Examples
Carbohydrate	yes	All groups: provide body with energy, keep you fit. Three groups - contain carbon, hydrogen, oxygen	All groups: potatoes Three groups: bread, biscuits
Fat	yes	All groups: needed to keep you warm, gives you energy. Three groups: too much makes you fat	All groups: oil, butter, chips, crisps, cheese, cakes/biscuits
Fibre	yes	All groups: associated with digestion of food (cleaning tubes) and health	All groups: Brown bread, cereals, whole wheat flour Group I - fruit + veg.
Minerals	yes	Five groups: needed for health, bones + teeth and blood	Five groups: vegetables and fruit Group V: liver for iron
Protein	yes	All groups: for health and growth	All groups: milk, eggs, lean meat, fish
Starch	yes	Four groups: a carbohydrate, gives you energy	Five groups: vegetables e.g. potatoes Group II: biscuits
Sugar	yes	Four groups: provides energy Groups I & II: sweet tasting foods bad for teeth	All groups: sweet. tasting foods e.g. cakes, fruit, biscuits, cereals.
Vitamins	yes	All groups: needed for health.	All groups: fruit + veg. Two groups: tablets

something about the functions of most nutrients. All children talked about the importance of fat in keeping people warm, many mentioned the term energy in this context. Children in three groups made connections between the amount of fat eaten and obesity. All groups linked proteins with growth and carbohydrates with energy. There was still some confusion about the differences between vitamins and minerals. The sources of vitamins in the diet were more clearly defined and three groups mentioned specific vitamins; vitamins were less frequently mentioned in the context of tablets. The increase in understanding about nutrients was not related to class teaching about nutrients although the class teacher had answered questions and discussed some issues related to the chemical structures of nutrients and their function in the body with individuals and small groups.

The Year 4 children, as might be expected, had more limited understanding of nutrient terms although individual children revealed some understanding of what specific nutrients were, for example C. stated that minerals were "like calcium and things". All of the children recognized the terms apart from starch; they were able to give examples of foods which contained specific nutrients and in some cases to explain what certain substances were. Vitamins were equated with tablets by all the children and linked to health. Values were ascribed to nutrients, for example sugar was described as bad for you. In one instance sugar was linked also to energy:

"Sugar gives you energy. It makes your teeth rot." (S)

4.3.4 Why do we need to eat food?

All the groups gave similar responses to this question. They recognized that food was concerned with energy and growth. The girls in two of the groups commented that "Some foods are bad for you", more specifically that sweet things and fat were bad for you.

4.3.5 Implications for further research

One of the purposes of the pilot study was to identify whether the interview structure used could be developed for use by teachers in a way which would be of benefit to them in their teaching and which would allow data to be analysed.

The pilot study indicated that the structured interview was amenable for use with pupils between the ages of eight and twelve. The study also indicated that thirty minutes was sufficient time to complete the investigation.

The cards with pictures had proved an effective strategy for focussing children's attention and helping them to clarify ideas. One difficulty in translating the activity for teachers was the need to use photocopied materials where some of the detail and clarity of the original drawings would be lost. The number of cards had also to be made more manageable. Fifty had been used originally but that number was reduced to thirty with the eight and nine year olds interviewed in June; this number had proved satisfactory and had not apparently affected the

groupings used or the food choices made.

The author had worked with groups as a means of getting to know children in an unfamiliar situation. The group activity, in which children negotiated and challenged each others ideas, was ideal for teaching and learning but was less amenable to systematic collection of data and subsequent analysis to discover what ideas individual children held. For this reason the activities had always been viewed as ones which teachers would carry out with individual children. Group activities could be used subsequently by teachers as a means of generating models of teaching and learning based upon the constructivist principles which were discussed in Chapter II.

4.4. Findings from Trials in schools 1987/1988

The major purpose of the trials was to evaluate the interview procedure, including the design of the background information and recording sheets which are shown in Appendices V and VI. The second purpose was to investigate further the ideas held by children about food and health.

4.4.1 Interviewing procedures

Prior to the trials, as was indicated in Chapter III, the author had met all the teachers who had volunteered to interview children. The purposes and structures of the interviews had been discussed and the need for standardisation of procedures and questioning stressed.

The notes of guidance (shown in Appendix V) also contained suggestions on the interview procedure and types of questions to ask.

Following the trial interviews by teachers, the author again met the teachers to evaluate the materials and to discuss their findings. These discussions indicated that although the teachers considered that the interviews had not posed major problems they had worried about whether they were "doing it right". They felt that they needed opportunities to become familiar with the materials prior to the first interview so that they did not have to refer to the 'script' when they were working with children. The trials highlighted the need for a 'dummy run' before teachers worked with pupils, and the importance of briefing teachers very carefully to ensure that, as far as was practicable, the interview structure and style of questioning was standardised.

These findings and suggestions were incorporated into the briefing sessions for teachers interviewing children from 1988 onwards.

4.4.2 Evaluation of the Record sheets and materials

The overall design of the record sheets enabled information on children's responses to be recorded readily. The spaces for comments proved useful for recording additional observations on things said by children which teachers found particularly significant or interesting.

The table for the food grouping activity, as can be

seen from Appendix VI, had examples of food groups which had been used by children in the trials, namely fruit, vegetable, meat, fish, sweet things. Spaces were left also for additional groups. In practice these headings, intended to help, proved a constraint as teachers tended, sometimes inadvertently, to influence children's choices of groupings. The headings were removed from the materials used after the trials. The narrow columns for recording the items in the selected food groups did not present difficulties. The cards were numbered, which enabled teachers to record the numbers of the cards in each group of foods chosen by a particular child rather than having to record the name of the food.

The table for recording information about children's ideas about nutrients, shown in Appendix VI, was generally regarded as satisfactory. The column headed 'definitions' proved problematic, however, as teachers found it difficult to decide what constituted an acceptable 'scientific' definition of particular words, also children in the trials rarely gave such definitions. For these reasons, this part of the record sheet was simplified in subsequent years. More time was also spent with teachers prior to the interviews in discussion about what might constitute a definition of a particular nutrient term.

The lack of colour in the photocopied pictures of food which were used in the trials did not appear to influence children's responses. What was important, particularly with younger children, was to ensure that when pictures were mounted on card to make handling easier the same colour of

card should be used for all the pictures. Different coloured backings sometimes led to children grouping the pictures according to the colour of the card.

4.4.3 Children's ideas

Information from the trials about children's ideas came from discussion with teachers allied to record sheets based on thirty-two individual interviews plus five group interviews; the ages and sex of the children in the trials are shown in Table 4. The data from the trials has not been included with the data from later interviews as the preparation for interviewing and the structure of the forms themselves were not identical, nor did the teachers include transcripts of discussion. The findings are, however, consistent with patterns observed both in the pilot study and interviews from 1988 to 1991.

4.4.4 Food grouping systems used by children in the trial study

Four of the teachers who completed record sheets recorded only the children they interviewed as grouping foods in those categories given in the headings to the columns in the record sheet, namely fruit, vegetable, meat, fish, sweet things and other groups. Four of the children interviewed, however, were aged five to six years and subsequent interviews suggest that some of these groupings, including meat and fish, are uncommon with children of this

age. It appears, as was noted earlier, that these teachers in the trial study were either influencing the children's groupings or ignoring categories of response which did not fit the column headings on the record sheets.

Two of the three children aged nine years, who were allowed to group food items without direction from the interviewer, used fruit and vegetable groups allied to a meal grouping system. The third child used a system based on attributes, soft and hard, plus types of packaging.

The foods included in the groups were normally those which were expected; however seven children, all aged 8 to 9 years, included crisps in groups which otherwise contained sweet tasting foods. The reasons for the inclusion of crisps in the groups was not clear from the record sheets but they may be similar to those which were discussed in section 4.3.1 and which are considered later in relation to the interviews during 1988 to 1991.

4.4.5 Food choices made by children in the trial study

The food choices made by children were similar to those in the pilot study and reflected the foods they would usually eat and which they liked. Breakfast was normally cereal and/or toast or bread, with a drink. One child indicated that this was a healthy choice. Other meals showed greater variety but the types of meals chosen were similar to those identified by children in the pilot study, which are illustrated in Tables 9 and 10. In choosing foods for lunch and tea/supper children always listed meat and/or

fish plus vegetables or sandwiches first, followed by sweet foods and drinks. This finding is consistent with those from the Pilot study and provides further evidence that the traditional idea of a meal consisting of savoury foods followed by a sweet dessert or fruit is a common one and part of the children's experience.

Snacks, which were described by one nine year old as "not too much, not too little", contained a mixture of fruit, drinks and crisps and sweets. The ten food items most commonly chosen by individual children for snacks are shown in Table 13. Biscuits and/or cake were the most frequently chosen items (56% children); crisps and sweets were selected by half the children. Milk and fruit were also commonly chosen, a total of fourteen children (44%) chose at least one item of fruit as a snack. Interestingly cheese was selected by a quarter of the children, either as a filling for a sandwich or on its own. Chips were selected by only four children, in two instances as fish and chips. The four children aged five and six years chose a greater variety of foods for snacks than older children, the items chosen by these younger children always included fruit and milk as well as bread, plus jam or cheese. The snacks chosen by younger children appeared to be a mixture of what they liked and normally ate plus 'treats' which they would choose if allowed a free choice.

Table 13

Snack foods most commonly chosen in trials 1987/88

n = 32

Food item	Number of times selected	% of children interviewed
biscuit/cake	18	56.3
crisps	16	50.0
sweets	16	50.0
fruit	14	43.8
milk	10	31.3
ice cream	9	28.1
cheese	8	25.0
coke/cola	8	25.0
bread/roll	8	25.0
nuts	5	15.6

4.4.6 Knowledge of nutrients

The data about children's ideas about nutrients comes from thirty-one record sheets. The number of children who recognized or had heard the words, gave examples of foods which contained individual nutrients and who were able to explain what the nutrients were and/or to explain their function in the body is shown in Table 14 and Figure 32.

From Table 14 and Figure 32 it can be seen that all the children recognized fat and sugar and that the majority also recognized terms such as vitamins, fibre and minerals. The words protein, starch and carbohydrate were less frequently recognized. In all cases the numbers of children able to give acceptable examples of foods which might contain the nutrients was less than those who appeared to recognize the word. Fewer children still were able to provide reasonable explanations of what the substances were, for example:

Fat - "greasy stuff put on things to stop them sticking" (girl, 5 years)

Fibre - "outside wheat, like string" (boy, 9 years)

Sugar - "little white squares" (girl, 6 years)
"white grains which are sweet" (girl, 8 years)

Vitamins - "healthy things found in food" (boy, 8 years)

Children rarely were able to suggest what the function of these substances might be in the body. For fat and sugar

Table 14

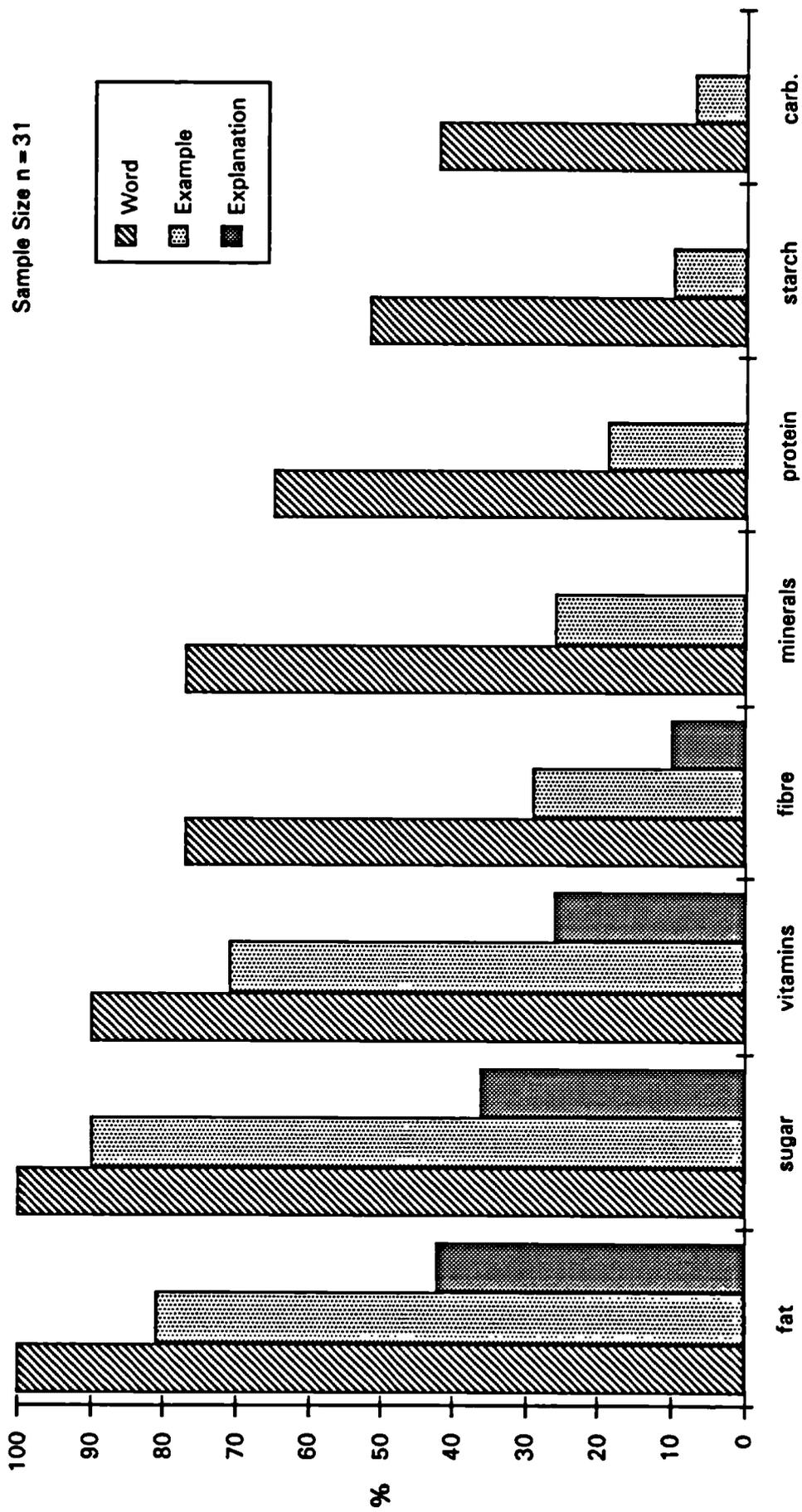
Children's ideas about nutrients - Trials 1987/88

n = 31

	Recognition of word		Explanation of word		Examples of foods given	
	n =	%	n =	%	n =	%
Carbohydrate	13	41.9	0	0	2	6.5
Fat	31	100	13	41.9	25	80.6
Fibre	24	77.4	3	9.7	9	29.0
Minerals	24	77.4	0	0	8	25.8
Protein	20	64.5	0	0	6	19.3
Starch	16	51.6	0	0	3	9.7
Sugar	31	100	11	35.5	28	90.3
Vitamins	28	90.3	8	25.8	22*	71.0

* Tablets as examples of vitamins = 15 children (48.4%)

Figure 32 Children's ideas about nutrients: Trials 1987/88



the numbers were higher than for other nutrients.

The responses given by the small number of five and six year olds in the sample were similar to those given by older pupils. There was no noticeable difference between the responses given by boys and girls. All of the younger children recognized the terms fat and sugar and were able to give examples of foods containing fat and sugar; none recognized the terms carbohydrate, fibre or starch. For children of all ages vitamins were associated with health and tablets; a total of fifteen children (48.4%) linked the term vitamins with tablets.

Although the sample was a small one it was possible to identify categories of responses in the explanations which children gave about fat, which are shown below. The number in brackets indicates the number of children giving each type of response:

- i. Grease or oil; (4)
- ii. Substance used in cooking; (6)
- iii. Part of food e.g. bacon, meat; (4)
- iv. Fat as something associated with fatness in people; (7)
- v. General statements e.g. "not very good for you". (2)

Some children gave responses which fell into more than one category e.g. "It makes you fat and ... for cooking" (J. girl, 9 yrs). No children in this sample gave the explanation used by pupils in the pilot group that fat is something which provides energy in the body. Five children described fat as something which was "bad for you".

Alternative ideas were apparent, particularly when children tried to explain what carbohydrate, minerals and proteins were:

- Carbohydrate: "a sort of colour to dye coca cola"
(S. girl, 10 yrs)
- Fibre: "takes away taste" (boy, 9 yrs)
- Minerals: "little chocolate things" (girl, 8 yrs)
- Protein: "like a tablet, gives you energy"
(boy, 9yrs.)
- Vitamins: "help you to lose weight" (boy, 8 yrs)
"Give you strength, take the place of
food." (girl, 9 yrs)

4.4.7 Children's ideas about why we need food

Information about children's ideas about why we need food comes from two sets of data. The first set consists of responses to the question posed during the trial interviews and the second from written responses to this question by children from six to eleven years in one of the trial schools.

During the interviews fifty-one children were asked why they thought we needed to eat food. This total is greater than the responses to the parts of the interview described in previous sections as one teacher, having interviewed four children individually, then asked all her five and six year olds to tell her their ideas.

The responses given by children are summarised in

Table 15. From this table it can be seen that it was possible to identify two main categories of response, the first consisting of positive responses and the second of negative responses. These broad categories have been further subdivided; positive reasons include life, growth, energy, strength/stamina, health/fitness; negative reasons include death, starvation, illness. The majority of children gave short, direct responses, for example:

- | | |
|-------------------------------------|--------------|
| "To keep us alive" | (boy, 9 yrs) |
| "Because if we didn't we would die" | (girl, 5yrs) |
| "We need food for growth" | (girl, 8yrs) |

The responses given by older children, as might be anticipated, were generally more detailed:

- | | |
|---|----------------|
| "We need food because it gives us energy, and makes us strong." | (girl, 10 yrs) |
| "We need food otherwise we would starve and die." | (girl, 9 yrs) |

The apparent discrepancy between the number of children interviewed and the number of responses in Table 15 is explained by these more detailed responses by older children. All children, bar two, gave responses which were either positive or negative; positive responses were more common at all ages. The two 'mixed' responses came from nine year old girls:

- | |
|--|
| "... to make energy or we would die... to grow." |
| "... gives energy, or you would die." |

Perhaps the most striking finding was that none of the children mentioned hunger as a reason for eating. One explanation could be that the children in this sample

Table 15

Children's ideas about why food is eaten - Trials 1987/88

n = 51

Positive reasons	Number of responses	Negative reasons	Number of responses
Life	11	Death	14
Growth	9	Starvation	5
Energy	5	Illness	2
Strength/stamina	6	Other negative	3
Health/fitness	4		
Other positive	10		
Total Positive responses	45	Total Negative responses	24

rarely, if ever, eat because they are really hungry. Hunger as a reason for eating was mentioned, however, by three girls aged 10 to 11 years who gave written responses.

The data from the children's written responses has been analysed in the same way as the data based on the interviews. A total of 116 children (61 girls and 55 boys), aged between six and eleven years, in one school wrote down why they thought they needed to eat food. The responses have been considered separately from the data from the interviews discussed above as the nature of the activity was different from that in which teachers were talking with children. Table 16 indicates the numbers of children giving positive and negative responses in each age group. From this table it can be seen that a larger number gave positive responses in all age groups than either negative or mixed reasons. The responses given by girls or boys were similar although a slightly greater proportion of girls gave negative reasons.

Analysis of the categories of responses, which are shown in Table 17 and Figure 33, points to an increase in the range and complexity of the responses as children become older. This finding is consistent with the findings from the interviews and can be explained by increasing maturity, including manual dexterity, and experience. Responses from six to eight year olds were limited to simple statements, for example:

"To keep us alive" (girl, 6 yrs)

"If you don't eat you will die" (boy, 6 yrs)

The reasons given by ten and eleven year olds included:

"I think we have to eat food to keep us going. Food is very important to us because without it we would die of hunger. Food helps us to work, to think, to do activities, and most of all food stops us from being hungry." (girl, 10 yrs)

"We need to eat food so that we can work, our body takes out the bits of food we need and throws away the rest and the bit we have got left we turn into energy." (boy, 10 yrs)

The majority of statements by children below the age of eight were linked to life and, more rarely, to health, energy or death. Growth, strength, starvation and illness were only mentioned by children older than eight years. Those responses which were grouped as "other" included statements which did not fit the broad categories identified in Table 17, for example:

"We need food to keep us going" (boy, 9 yrs)

"... because it helps the heart pump the blood round your body." (boy, 9 yrs)

The responses given by girls and boys in the sample were similar, as had been the case in the interview responses.

Although the findings from this survey are of interest they are not necessarily characteristic of other schools. The results do, however, provide useful data for comparison with findings from interviews with children undertaken by teachers from 1988 to 1991 which are discussed in the following sections of this chapter.

Table 16

Children's ideas about why food is eaten; summary of responses from one school (February 1988)

n = 116; 61 girls, 55 boys

Age of children	n =	Positive response			Negative response			Mixed response		
		girl	boy	both	girl	boy	both	girl	boy	both
6-7 yrs	21	9	6	15	3	1	4	1	1	2
7-8 yrs	23	8	10	18	1	3	4	0	1	1
8-9 yrs	24	7	5	12	4	1	5	2	5	7
9-10 yrs	15	4	9	13	1	0	1	0	1	1
10-11yrs	33	9	8	17	3	0	3	9	4	13
Total number	116	37	38	75	12	5	17	12	12	24
% children	100	61	69	65	20	9	15	20	22	21

Table 17

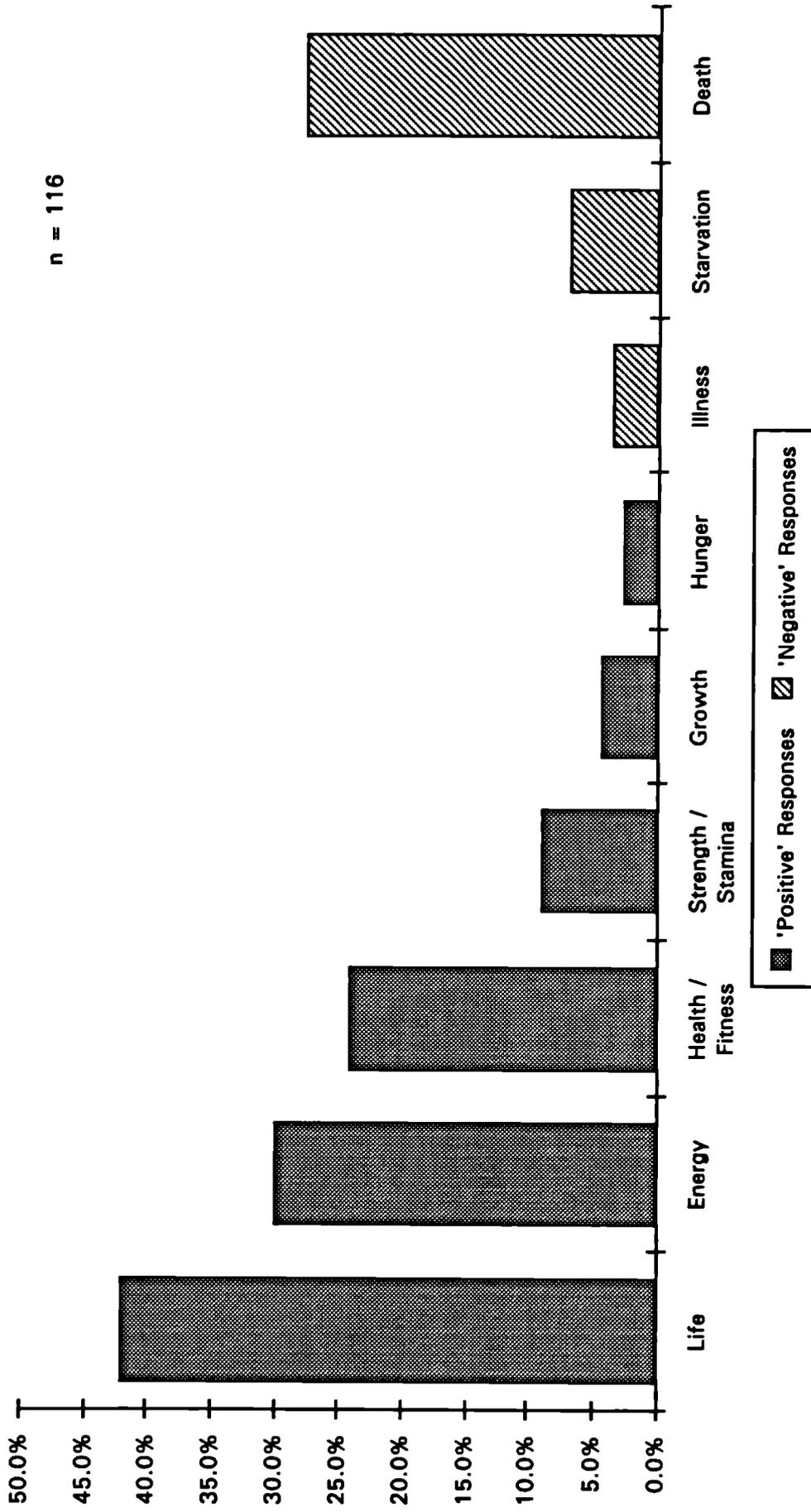
Why do we need food?

Categories of responses given by children of different ages in one trial school. (February 1988)

n = 116; 61 girls, 55 boys

Category of response	6-7 yrs n = 21	7-8 yrs n = 23	8-9 yrs n = 24	9-10 yrs n = 15	10-11 yrs n = 33	Total	% chn
Life	12	12	12	3	10	49	42.2
Growth	0	0	3	0	2	5	4.3
Energy	1	5	9	5	15	35	30.1
Strength /stamina	0	0	2	3	5	10	8.6
Health/fitness	4	2	6	2	14	28	24.1
Hunger	0	0	0	0	3	3	2.6
Other positive	1	1	4	3	4	13	11.2
Death	4	5	7	1	15	32	27.6
Starv'n	0	0	4	1	3	8	6.9
Illness	0	0	1	0	3	4	3.4
Other negative	0	0	1	0	0	1	0.9
Total no. response	22	25	49	18	74	188	

Figure 33 Why do we need food? Trials 1988



4.5 Findings from interviews 1988 - 1991

The findings from the interviews carried out between 1988 and 1991 constitute the major part of the data collected. As can be seen from Table 3 data from interviews with a total of 212 children have been analysed. Each teacher interviewed three children on a one to one basis; three teachers interviewed additional children; one teacher only interviewed two children because of lack of time. During the interviews teachers sought to find out about children's ideas about four things:

1. food grouping,
2. food choice,
3. knowledge of nutrients,
4. reasons for eating food.

The way in which pictures of food were used as the basis for the activities was described in Chapter III. Data were collected by means of tape recordings of the interviews, record sheets and notes compiled during the interviews. The findings for each activity are discussed in subsequent sections of this chapter.

4.6 Food grouping systems

Eight categories of grouping systems were identified in the interview responses:

1. Classification based on groups of foods such as fruit and vegetables;
2. Grouping based on associated foods, for example bread and jam, fish and chips;

3. Meal grouping, for example breakfast foods;
4. Healthy/unhealthy;
5. Physical attributes of food, for example taste, colour;
6. Liked/disliked foods;
7. Food source, for example where grown or bought;
8. Alphabetical or numerical ordering.

The number of children using these eight categories is shown in Table 18 and Figure 34. The last of the categories, namely alphabetical or numerical ordering, does not represent a food grouping system and is therefore not included in the more detailed analysis, shown in Table 19 and Figure 35, which indicates the number of children of different ages using each type of category. From Table 18 it can be seen that just over two thirds of the children interviewed (69.3%) used more than one of these categories when grouping foods.

Children of all ages most commonly used a grouping system based on the type of classification which is now advocated by nutrition educators, namely fruit and vegetables, meat and fish, bread and other cereals and fats. The majority (67.9%) used this classification system or placed foods in associated groups or pairs (68.4%). Just under a third (31.6%) used a meal grouping system; when this form of grouping was used it was generally related to foods eaten for breakfast. From the groupings it seemed that many foods grouped in associated pairs, for example, chicken and rice, could be interpreted as what is eaten together as part of a meal.

Table 18

Food grouping systems used by children 1988 to 1991

n = 212 (girls = 113; boys = 99)

Food group categories used	girls n= %	boys n= %	Total	%
More than one category used	76 67.3	71 71.7	147	69.3
Classification	83 72.6	61 61.6	144	67.9
Associated foods e.g "go together", taste similar	77 68.1	68 68.7	145	68.4
Meal grouping	33 29.2	34 34.3	67	31.6
Healthy and/or unhealthy	21 18.6	20 20.2	41	19.3
Physical attributes e.g. shape, colour, texture	17 15.0	22 22.2	39	18.4
Like and/or dislike	8 7.1	11 11.1	19	9.0
Sources of food e.g. where grown or bought	5 4.4	2 2.0	7	3.3
Alphabetical or numerical grouping	4 3.5	1 1.0	5	2.4

Table 19

Food grouping systems used by children of different ages

n = 212

Age of ch'n		Class	Assoc	Meal gr'p	H'th	Phys attr	Other	Mixed group
	n=	n =	n =	n =	n =	n =	n =	n =
3 - 5	5	0	2	1	0	2	3	2
5 - 6	20	10	14	4	2	9	4	11
6 - 7	28	16	22	8	1	7	8	20
7 - 8	54	37	41	16	5	14	16	41
8 - 9	36	25	26	14	7	4	3	28
9 -10	39	31	24	15	11	1	1	26
10-11	18	14	8	6	10	0	1	10
11-12	6	6	4	2	2	0	0	4
12-13 *	6	5	4	1	3	2	0	5
Total /cat.		144	145	67	41	39	36	147
% of ch'n		67.9	68.4	31.6	19.3	18.3	17.0	69.3

Note: 1. 'Other' does not include alphabetical and or numerical grouping shown in Table 18

2. * oldest child interviewed = 12 years 4 months

Figure 34 Food groups used by children 1988 to 1991

n = 212

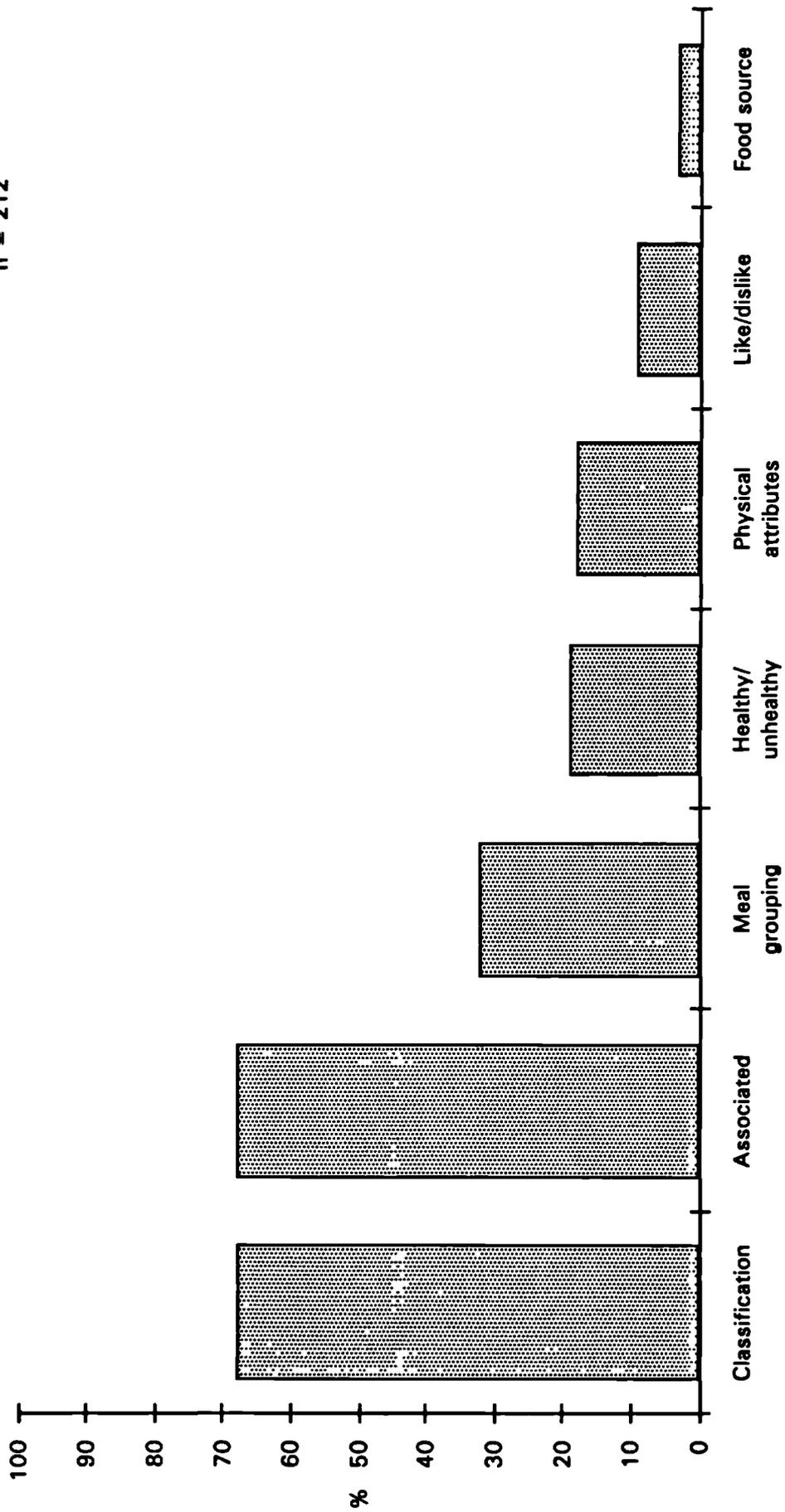
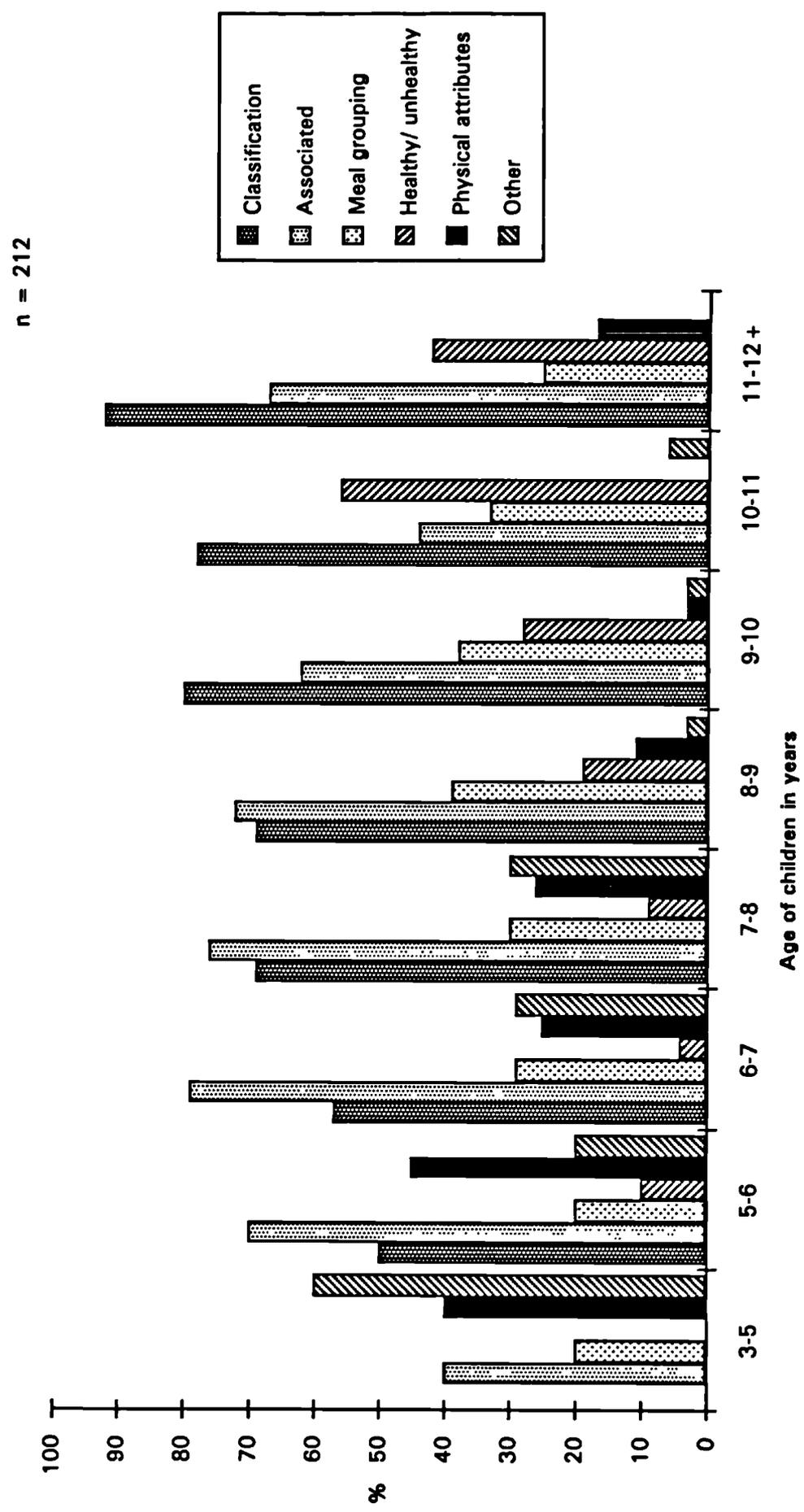


Figure 35 Food groups used by children of different ages



There was little difference between the numbers of boys and girls using any of the food categories listed above. The proportion of girls using a classification system (72.6%) was slightly higher than was the case for boys (61.6%). Groupings based on classification were also more common amongst children above the age of seven years, whilst the proportion creating groups based on associated foods or physical attributes fell, as can be seen from Figure 35. None of the small group under the age of five years used groupings based on a system of classification. Some of these differences can be accounted for by the age of the children and their stage of development allied to their prior experiences, which are discussed below and also in section 4.11.

The foods most commonly classified were fruit and vegetables, as can be seen from Table 20 and Figure 36; 82.6% of children using a classification system placed fruit and vegetables either in a separate or composite group. The next most common grouping was one based on sweet foods (65.3%), followed by meat and/or fish (36.8%) and drinks (27.8%). Only two children below the age of eight years formed groups based on dairy products. Wheat and/or other cereal groupings were infrequent. Only three children, aged between eight and ten years, used a grouping system based on nutrients such as protein, fats, and carbohydrate. Some children grouped foods in ways which suggested they were developing some understanding of nutrient groupings, for example child 39, age eight years,

Table 20

Food classification systems used by children of different ages.

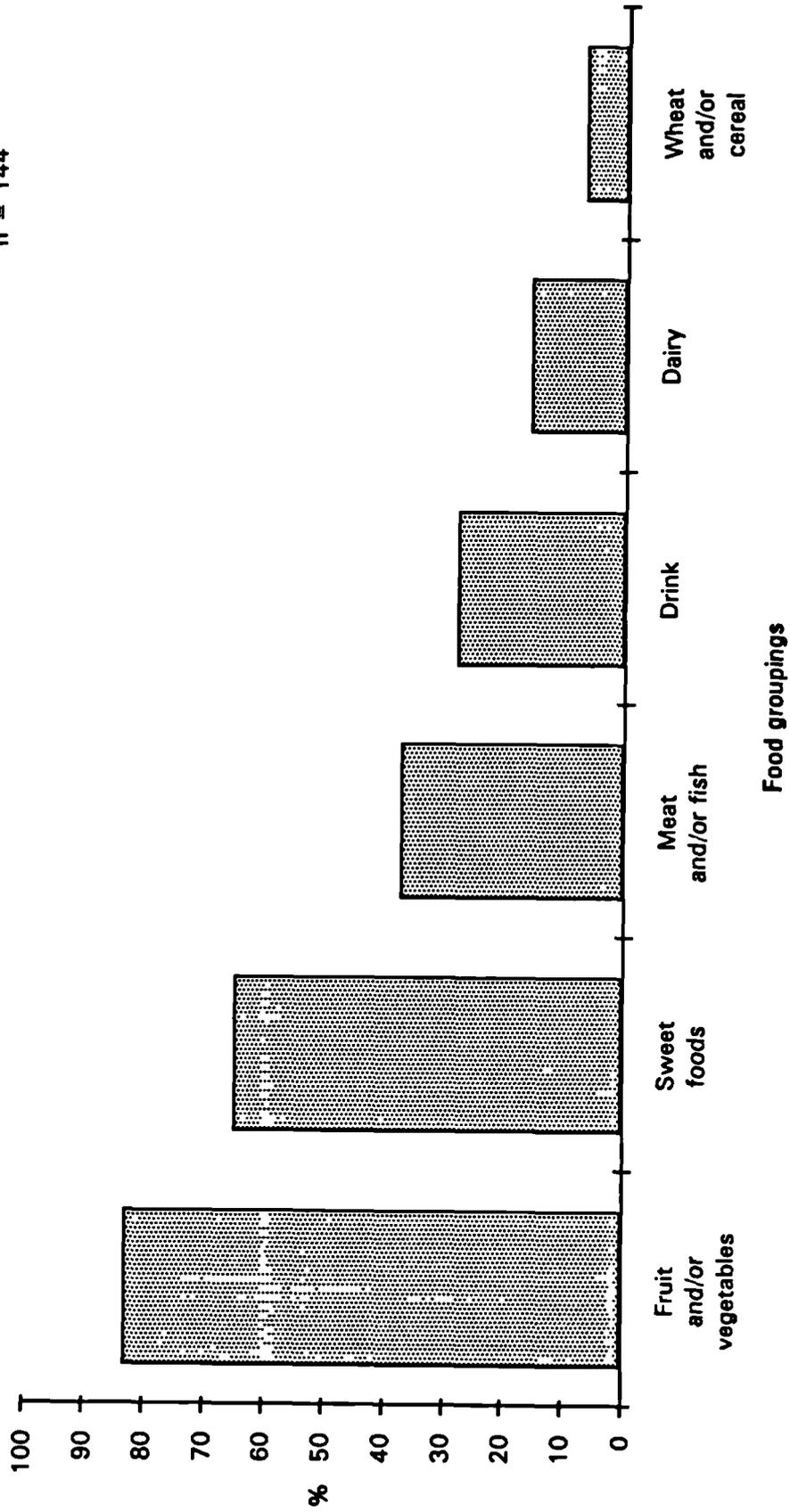
n = 144

Age of ch'n.	n =	Fruit &/or veg.	Meat &/or fish	Sweet foods	Drink	Dairy	Wheat &/or cer'l
3 - 5	0	0	0	0	0	0	0
5 - 6	10	7	4	4	3	0	0
6 - 7	16	9	4	11	2	1	0
7 - 8	37	30	15	23	15	1	0
8 - 9	25	21	8	19	5	4	1
9 - 10	31	29	14	18	9	7	2
10 - 11	14	13	4	11	3	6	2
11 - 12	6	6	2	3	1	2	1
12 -13*	5	4	2	5	2	2	2
Total per cat'y	144	119	53	94	40	23	8
% of ch'n.	100%	82.6%	36.8%	65.3%	27.8%	16.0%	5.6%

Note: * age of oldest child interviewed = 12yrs 4mths

Figure 36 Classification systems used by children 1988 to 1991

n = 144



grouped bun, cereal, rice, bread and cake together although she was unable to explain why she had made this grouping. She had already classified other items such as drinks and fruit, which suggests that she was classifying foods rather than just assigning them to random groups.

In most instances there was a close match between the names given to groups and the foods placed in those groups although there were exceptions. Thirty-three of the ninety-four children (35%) who identified a 'sweet' group of food items included crisps and chips in the group. The number in any one age group, as can be seen from Table 21, is too small to be considered as statistically significant, but the pattern of response is a consistent one across different age groups. Table 21 also indicates that girls used this type of grouping more frequently. In some cases, as had been found in the pilot study, children suggested that the reasons for placing crisps in a 'sweet' group were related to crisps being perceived as "bad for you". There are, however, other possible reasons for the inclusion of crisps with sweet foods, including children's ideas about the term 'sweet' and these will be considered later in section 4.8.

The number of children categorising foods as healthy and/or unhealthy was small, just under twenty per cent, and appeared to be more common above the age of nine years. Twenty-four of the forty-one children grouping foods in this way identified both healthy and unhealthy foods, the remainder selecting foods in only one category. The numbers of boys and girls identifying healthy and unhealthy foods

Table 21

Numbers of children of different ages classifying crisps and chips as sweet foods

	Sweet foods grouped	crisps as sweet	crisps as sweet	chips as sweet	chips as sweet	Total
Ages of children in years	n =	girls n =	boys n =	girls n =	boys n =	girls + boys
5 - 6	4	2	1	1*	0	3
6 - 7	11	3	0	0	0	3
7 - 8	23	4	2	1*	0	6
8 - 9	19	3	2	0	1*	5
9 - 10	18	3	2	0	1*	5
10 - 11	11	4	3	0	0	7
11 - 12	3	1	1	0	0	2
12 - 13#	5	0	2	0	0	2
Total	94	20	13	2	2	33

Note:

* Also classifying crisps as sweet

Age of oldest child interviewed = 12yrs 4mths

was almost identical (21 girls; 20 boys) and there was very little difference in the foods selected as healthy or unhealthy by different age groups. The types of foods selected as healthy or unhealthy are listed in Tables 22 and 23. The foods most commonly categorised as healthy were fruit and vegetables but bread, breakfast cereals, rice and cheese were chosen by fifteen children. Unhealthy foods comprised those high in sugar or fat, the exception was cheese which was identified as healthy despite its high fat content. The findings suggest that these children were able to distinguish between foods which are commonly thought to be healthy and those which are unhealthy, namely those which are high in fat or in sugar, a finding which is consistent with results from Activity 3 which are discussed in section 4.8.

In considering possible reasons for the types of classification systems used in this activity it is important to recognize that classifying, as Millar and Driver (1987) point out, is a skill:

"which lies at the root of cognition" (p.43).

Children begin to classify from an early age as a means of making sense of their experiences. The classification systems which they use, however, may be different from those of, for example, nutritionists. One purpose of science education should be to help children to understand the classification systems used in science, including the reasons for their use. Issues related to children's experience of classification, in particular the implications for teaching about food, will be returned to in section 4.11.

Table 22**Foods identified as being healthy****(n = 29)**

Foods identified as healthy	Number of times selected
Vegetables (including potatoes)	25
Fruit	20
Breakfast cereals	15
Bread/rolls	15
Cheese	15
Fish	15
Rice	13
Milk	12
Eggs	11
Nuts	9
Chicken	7
Other e.g. pizza, olives	2

Table 23

Foods identified as being unhealthy

(n = 36)

Foods identified as unhealthy	Number of times selected
Foods containing sugar e.g. cakes, biscuits, ice cream	32
Sweets	28
Crisps	28
Chips	25
Coke/cola	21
Foods containing fat or cooked in fat e.g. sausages, burghers	13

One of the factors which could have affected the food groupings used by children in the interviews was prior teaching. This factor had been found to be important in the pilot study, which had identified some of the ways in which children's thinking developed whilst studying a food related topic. For this reason teachers were asked to record information about aspects of food which had been studied by the children interviewed in the previous six months. Fifty-four of the 212 (25%) children interviewed had been taught a food related topic in the previous term or were studying such a topic in the term in which the interviews were taking place. Table 24, which provides a summary of the varied topics taught, indicates that some of these topics included classification of fruit and vegetables or identification of healthy and unhealthy foods.

The 'profiles' of responses given by children who had been taught about food are shown in summary form in Table 25. When these responses are compared with Table 19, which indicates the overall pattern of responses by children of different ages, it appears that teaching has little effect on the food groupings used by individuals. The number using a food classification system after teaching is slightly higher and the proportion of children using other forms of groupings is slightly lower. Although these findings are of interest, the number of children involved is not large and therefore the differences in numbers cannot be regarded as significant. The five children below the age of six years who did not use a food classification

Table 24

Teaching about food; examples of topics taught to children of different ages prior to and during interviews 1988-1991

n = 54 children in 18 classes

Age of children	Child code	Details of topic taught
Year 1 (5-6)	88- 91	Farms (previous year); harvest (previous term)
	168-170	Fruit and vegetables - sorting by colour and shape (previous term)
Year 2 (6-7)	95- 97	Integrated topic on time which included harvest and favourite foods
	122-124	Food - 'Bread' (rice, wheat, flour, etc.) and favourite foods
	148-150	Fruits and seeds (previous term)
Year 3 (7-8)	25- 27	Cooking - pancakes, pakora, icecream (previous year)
	107-109	Senses topic (taste); dental hygiene
	125-127	Food topic, main focus on packaging (current topic)
	153-155	'Ourselves' - teeth, good and bad food (previous term)
Year 4 (8-9)	85- 87	Food topic; emphasis on health and food choice (current topic)
	128-130	Food - Natural/processed foods; nutrition and diet (current topic)
	131-133	Food topic; food constituents (previous term)
	134-136	'Ourselves' - included menu planning, activities related to taste and smell
	156-158	PSE - taking care of ourselves, includes diet and health (current topic)
Year 5 (9-10)	119-121	'Food, diet and ourselves' (current topic)
	192-193	'Ourselves' including diets and sensible foods (previous term)
Year 6 (10-11)	64- 66	'Healthy eating' (previous year)
	82- 84	'Healthy eating' diets, food groups (previous term)

Table 25

Food grouping systems used by children who had been taught a food based topic.

n = 54

Age of ch'n		Class	Assoc	Meal gr'p	H'th	Phys attr	Other	Mixed group
	n=	n =	n =	n =	n =	n =	n =	n =
3 - 5	0	0	0	0	0	0	0	0
5 - 6	8	3	4	2	0	5	1	5
6 - 7	8	6	5	1	0	3	1	5
7 - 8	12	8	6	2	0	1	2	7
8 - 9	13	11	9	6	0	0	0	11
9 -10	7	7	4	4	1	0	0	6
10-11	6	5	1	1	3	0	1	3
11-12	0	0	0	0	0	0	0	0
12-13	0	0	0	0	0	0	0	0
Total no. ch'n	54	40	29	12	4	9	5	37
%		74.1	53.7	22.2	7.4	16.7	9.3	68.5

system used one based on the colour or shape of the food items; three of these children, as can be seen from Table 24, had considerable experience of sorting fruit and vegetables by colour and shape in the previous term. Even without such teaching the rich environments provided in most nursery and infant classrooms, which commonly contain collections of items which can be handled, including fruits and vegetables, means that grouping by shape and colour is a common experience for many children of this age. Groupings based on such experiences can also be expected from children in infant classes, most of whom are in the stage of transition from intuitive to concrete operations identified by Piaget (Piaget and Inhelder, 1969).

Teachers commented frequently on the mismatch between the grouping systems used by children when interviewed and the food grouping systems which they had been taught; this was particularly true of older children in junior classes. This finding is consistent with those of Newsome (1983) which were discussed in Chapter II and has evident implications for teaching which are examined in section 4.11 and also in Chapter V.

The grouping systems used by children in this activity are consistent with those identified in the studies by Newsome, and also by Holland (1981), which were discussed in Chapter II (section 2.5), and with the pilot and trial studies discussed earlier. The author has not categorised the responses in the same way as Holland and Newsome, for example as context independent or objective, as the varied classroom experiences of the children interviewed mean that

it is difficult to determine such categories with any certainty, even if they are valid descriptions. The proportion of children using different grouping systems is not the same as earlier work; these differences can be explained in part by the relatively small number of children interviewed, particularly by Holland. There were differences also in the age ranges of the children interviewed. Newsome, for example, was working with pupils in secondary schools. The purpose and structure of the interviews was also different. A further important, and possibly significant, difference, is that in the study described here the interviews were carried out by teachers who knew the children concerned. Teachers may be able to elicit responses more readily, particularly from the less confident, than researchers. Conversely children may be more ready to give teachers the responses they think are required! Discussion and trialling of the procedures prior to the interviews in schools was a useful way of alerting teachers to the importance of these variables.

4.7 Food choice

In analysing the data on food choices it is important to stress that the data collected provide information about the choices made by children based on the cards used during the interviews; the interviews did not seek to collect evidence about what they actually eat. The findings do, however, provide indications of the sorts of foods which children might select if given freedom to choose. In

making their choices of food items for meals children normally chose those foods which they said they normally ate at home or for school lunches and which they liked or considered to be favourite foods. Younger children, in explaining why they might choose particular foods, frequently stated that they would eat these foods because their parents said they were good for them. A minority of children of all ages cited health reasons for their choices; these were not necessarily those who had grouped foods as being healthy and/or unhealthy in the food grouping activity or who had learnt about food in the previous term. These findings were consistent with those obtained in the pilot and trial interviews.

Information about the food choices made by children for different meals and snacks is given in Tables 26 to 30; the most commonly selected food items for breakfast and snacks are shown in Figures 37 and 38. There was little difference in selections made by girls and boys or in those made by children of different ages. The majority made choices based on the pictures, or their interpretations of the pictures; children of all ages extended the foods chosen to other food items, for example, samosas or pizzas. Children below the age of eight were more likely to list everything that they would like to eat for any one meal; however, these were exceptions to a general pattern in which children selected items which reflected the type of meal which they customarily ate. Some teachers when reporting on the interviews expressed disappointment that their pupils' food choices for meals were so sensible and ordinary!

Table 26

Foods selected by children for breakfast

n = 212

Food item selected	Number of children choosing food	Percentage of children interviewed
Toast/bread/chapatti	157	74.0
Cereal	127	59.9
Milk/milky drink	113	53.3
Egg e.g. boiled or scrambled	43	20.3
Fruit or fruit juice	34	16.0
Other cooked items e.g. sausages, fish	28	13.2

Table 27

Food items most commonly selected as snacks

n = 212

Food item selected	Number of children choosing food	Percentage of children interviewed
Fruit and/or vegetables	89	42.0
Crisps	76	35.8
Sweets/chocolate	64	30.2
Biscuits/cake	55	26.0
Ice cream/jelly	53	25.0
Coke/cola	36	17.0
Other drinks e.g milk, fruit juice	24	11.3
Bread and butter/sandwiches	24	11.3
Nuts	18	8.5
Chips	17	8.0

Figure 37 Foods selected by children for breakfast 1988 to 1991

n = 212

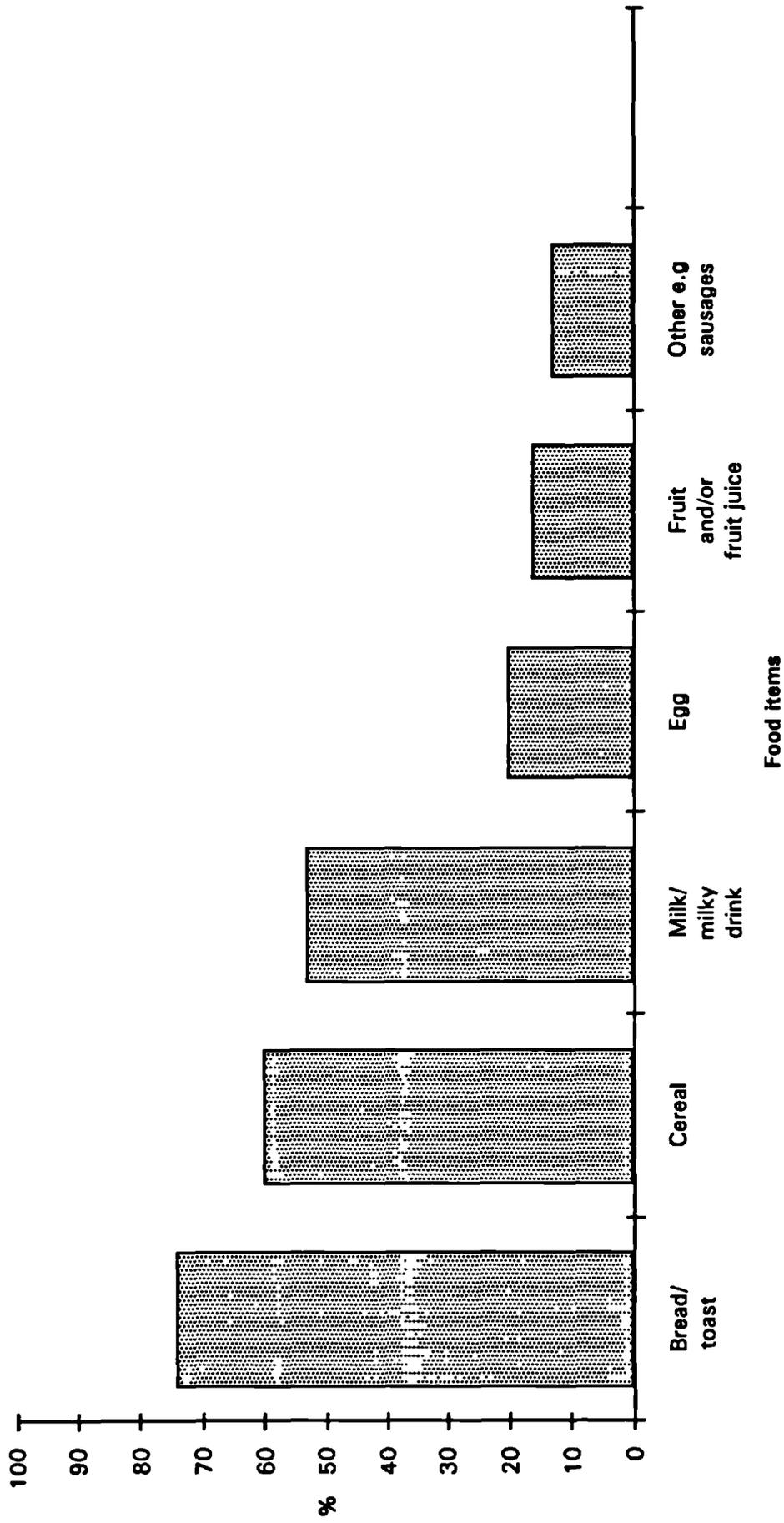


Figure 38 Foods most commonly selected as snacks 1988 to 1991
 n = 212

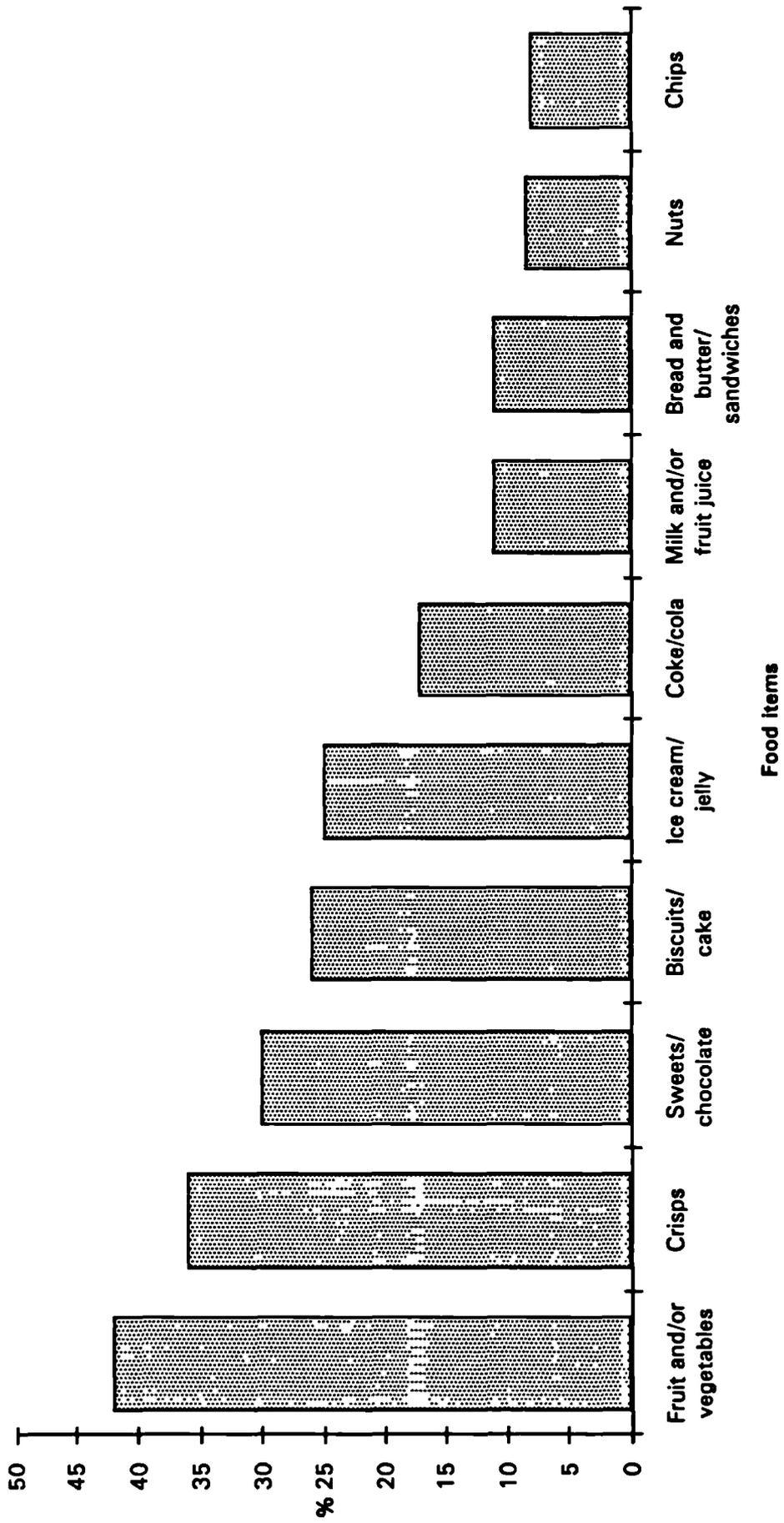


Table 28

Examples of snacks selected by children of different ages

age of child	child code	snacks
5.00	165	crisp sticks, lolly, piece of cheese
5.04	61	banana, orange
5.07	12	crisps, sweets
6.01	11	fruit, crisps, sweets
	63	sweets, bread and jam
	53	apple, coke, bread + butter, cheese
7.00	19	banana, oranges, coke, bread, cheese
7.01	21	strawberries, sweets, ice-cream, coke, cake
7.07	111	jelly + ice-cream, cakes, sweets, strawberries
8.01	39	strawberries, ice-cream
8.03	129	glass of milk, bar of chocolate
8.05	13	orange, milk
9.00	17	crisps, sweets, cola, ice-cream
9.02	7	crisps, sweets, cola, ice-cream
9.07	68	biscuits, milk
10.02	34	crisps, sweets, coke
10.05	204	crisps, sweets, orange, banana + other fruit
10.11	64	apple, sweets, chocolate or wholemeal biscuit, Crunchy bar
11.07	143	fruit, water
12.02	113	sweets, ice cream, sweets, chips

Table 29

Examples of foods selected for lunch by children of different ages

age of child	child code	lunch
5.00	165	(packed lunch) cheese in sandwich, bread, butter, crisps, three or four sweets
5.04	61	cheese and chips with chutney, corn, ice cream, bread and butter
5.07	12	bread, margarine, cheese, milk
6.01	11	corn, egg, lettuce
	53	fish, chips, coke
7.00	19	cauliflower, chips, fish, rice pudding
7.01	21	orange, carrots, cheese, milk
7.07	111	fish, potato, beans
8.01	39	chips, chicken
8.03	129	sandwich with ham, lettuce, tomato, crisps, cola
9.00	17	bread, cheese, orange juice
9.02	7	sandwiches with fish, cheese, bread, banana, crisps, cola
9.07	68	orange, biscuit, bread, cheese, crisps
10.02	34	cheese, bun, margarine, cake, apple
10.05	204	cheese, bread, banana, crisps, fizzy drink or juice
10.11	64	crisps, chicken drumstick, strawberries, yogurt
11.07	143	sandwiches, tomato, crisps, banana
12.02	113	(school dinner) chicken, corn on the cob, chips

Table 30

Examples of foods selected for tea/supper by children of different ages

age of child	child code	tea/supper
5.00	165	chips, mashed potatoes, not peas, sauce
5.04	61	baked beans and sauce, cake
5.07	12	fish, chips, milk
6.01	11	carrots, crisps, strawberries, jelly fruit
	53	potatoes, carrots, rice, milk, ice cream
7.00	19	bread, cheese, egg, banana, jam, cakes, tea
7.01	21	sweetcorn, chicken, butter
7.07	111	bun, butter, milk
8.01	39	potato, tomato, coke
8.03	129	hamburger, peas/beans, chips
9.00	17	pizza, chips, water
9.02	7	fish, chips, potatoes, tomato, apple crumble
9.07	68	chicken, fish, potato, lettuce/cabbage, milk, jelly
10.02	34	chips, beans, carrots, scrambled egg, milk
10.05	204	chicken, potatoes, carrots, peas or beans
10.11	64	pop drink, chicken, corn on the cob, carrots, potato, egg, nuts, flan or apple pie
11.07	143	chicken, rice
12.02	113	tomato, lettuce, carrots, fish, potato, coke.

That the concept of a meal was understood by children of all ages was indicated by the order in which they selected foods, for example pizza or sandwiches were listed before fruit or 'puddings' when selecting food items.

From Table 26 it can be seen that the most commonly selected breakfast food was bread or toast, which was mentioned by seventy-four per cent of children. These children also specified what would be eaten with their toast, for example butter/margarine with jam or scrambled egg on toast. Sixty per cent also selected breakfast cereals and more than half of these indicated that they would also have toast/bread. Milk was mentioned by just over fifty per cent of children; many of these specified clearly that they would have milk to drink rather than just having milk on cereal. This finding can be related also to information on snack choices where milk was selected as a drink by sixteen(⁸/₁₆per cent), most frequently by children below the age of eight years.

A sample of the foods chosen for snacks by individual children is shown Table 28 (choices made by these children for lunch and tea/supper are shown in Tables 29 and 30); the items mentioned most frequently are listed in Table 27 and Figure 38. What is particularly interesting is that although crisps and sweets are high on the list of snacks chosen, fruit, and more rarely things like carrot sticks, was mentioned more frequently (42.0 per cent of responses) than any other single item by all age groups other than those above the age of ten years. Although the proportion of children of different ages choosing particular snack

items, for example crisps, chips, ice cream, cakes and biscuits was similar there were differences in the numbers selecting sandwiches/rolls and coke/cola. Sandwiches were rarely selected by children above the age of nine years; coke/cola was chosen by only one child below the age of seven years. The overall pattern of responses is similar to those obtained in the trial interviews which are shown in Table 13.

Children were on occasions very perceptive about their choices, for example R (aged 8 years), in giving reasons for choosing beefburger and chips for supper, explained:-

"If you fry it, it isn't good for you, but if you like it, you want it."

The comments on snacks were also revealing, for example:-

"What I am allowed",

"I eat these on the way to school",

"If you had too much you wouldn't eat your dinner",

"I like all these. I know they're not good for me."

The links between health and the foods chosen were apparent from statements such as the last one, as was the recognition that foods were eaten because they were liked even when they were recognized as unhealthy. Issues of health and diet will be considered in more detail in section 4.10. Sometimes comments were more specific, for example that by C, who listed sweets, jelly, ice cream, crisps, and gob stoppers as snack foods and then commented:

"They make my teeth rotten." (9 years)

Sometimes children mentioned attributes of food in discussing their choices, as is evident from this comment by a teacher:

"On occasions D (10 years) made references to the benefits of certain foods - for example to toast which will 'warm me up' and to an apple which will 'freshen me up'." RSC

Children with specific dietary requirements, for example diabetics or those with diagnosed food allergies, showed considerable understanding of foods which could be eaten/not eaten. Diabetic children normally linked foods to sugar intakes and energy expenditure, for example E (aged 8 years), recognised that she needed to have a biscuit, or chocolate, before she took the dog for a walk after school. She knew also that she could not eat a lot of 'favourite' foods like jam because they had too much sugar in them.

The multiplicity of factors which govern food choice have been explored in earlier chapters and are summarized in Figure 2. The importance of these factors, including family food patterns and other social influences, are evident in the responses given by children in these interviews. The findings provide information about the influence of these factors on children's choices and, equally important in the context of the study reported here, helped to alert teachers to the complexity of the issues implicit in any study of food choice.

4.8 Knowledge of nutrients

Before examining the data concerning understanding about individual nutrients it is helpful to consider the overall patterns which emerged and also what significance can be placed on the findings. As was indicated in the discussion in Chapter II, many of the concepts involved in the study of nutrients, including their function in the body and what happens to food when it is ingested, are unlikely to be understood by children in primary schools. The purpose of the study described here was to determine what ideas are held about nutrients based on previous experience, for example through teaching, media or family, so that teachers could identify appropriate teaching strategies which utilized the understandings which children have.

As was noted earlier, because of the small sample size, the results are not regarded as statistically significant. Also, the nature of the task in this part of the interviews had some bearing on the results. Nonetheless, the information obtained does provide indications of the range of the ideas held by children, including those which are different from those of nutritionists.

The number and percentage of children recognizing different nutrient terms is indicated in Table 31 and Figure 39. The data include responses from all the 212 children interviewed between 1988 and 1991. From Table 31 and Figure 39 it is apparent that three nutrient terms,

namely sugar, salt and fat were recognised by over ninety per cent of the children. The word vitamin was recognised by eighty-five per cent. The numbers of children recognizing terms such as fibre, mineral and protein was lower, just over fifty per cent.

Data about carbohydrates and starch have not been included in Figure 39 as not all children were asked this question. Of those who did respond to questions about these terms just over thirty per cent recognised the two words.

Both Table 31 and Figure 39 include information about the number of children who were able to give some acceptable explanation about each nutrient and to provide examples of foods which might contain such nutrients. The word explanation is used in preference to definition as what was said in most cases represented a common sense view of the nutrient based on prior experience, rather than something which could be regarded as a scientific definition. Sugar and salt were the two terms where children were able to provide what amounted to definitions, for example "small, white crystals", although they do not approach an understanding of the nutritional use of the term. Fat was frequently described as "the stuff round meat" and vitamins were invariably described as pills or tablets. From Table 31 and Figure 39 it can be seen that less than eight per cent of the children interviewed were able to provide any explanation of terms like fibre, minerals or protein.

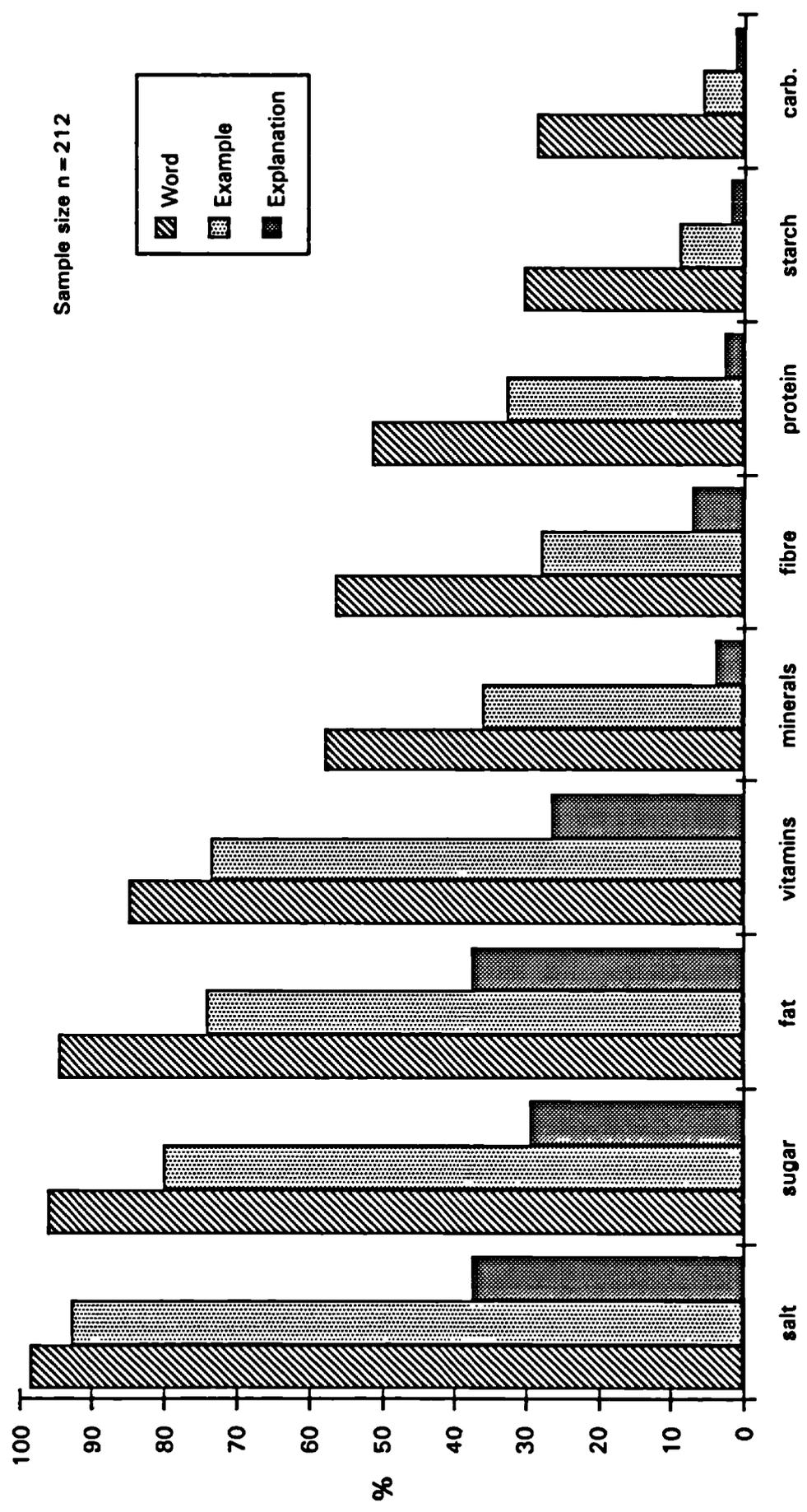
Table 31

Children's ideas about nutrients; interviews 1988 to 1991

n = 212

	Recognition of term		Explanation of term		Examples of foods	
	n =	%	n =	%	n =	%
Carbohydrate	60	28.3	3	1.4	12	5.7
Fat	204	96.2	62	29.2	171	80.1
Fibre	123	58.0	8	3.8	76	35.8
Minerals	120	56.6	15	7.1	59	27.8
Protein	109	51.4	10	4.7	69	32.5
Salt	201	94.8	79	37.3	157	74.1
Starch	64	30.2	4	1.9	19	9.0
Sugar	209	98.6	79	37.3	197	92.9
Vitamins	180	84.9	56	26.4	156	73.6

Figure 39 Children's ideas about nutrients: Interviews 1989/91



When the responses from different age groups are examined the patterns are in many respects similar to those shown in the overall figures. The types of responses by girls and boys are similar. There are indications of progression in thinking in relation to the age of the child. Ten year olds are more knowledgeable and even when they were unable to provide explanations about particular nutrients, they were able to make reasonable guesses about foods which might contain the nutrient. Furthermore, older pupils have a greater facility with language, as is evident in the responses which they gave to specific questions.

Children with specific dietary needs showed greater understanding about specific nutrients than most children of their age, as they did when making food choices (Section 4.7).

4.8.1 Fat

As can be seen from Tables 31 and 32, and Figure 39, most children (96%) had heard of fat and most of these (80% of all children) could give examples of foods which contain fat. Fewer children, twenty-nine per cent of all those interviewed, could provide a reasonable explanation of fat based on their own experience, for example fat as part of meat. The responses given by girls and boys were similar although the proportion of girls able to provide examples and explanations about why fat was eaten was slightly higher.

Table 32

Children's ideas about fat

n = 212 (girls =113; boys =99)

Age of children	Recognition of word			Explanation of fat			Examples of foods containing fat		
	girl	boy	total	girl	boy	total	girl	boy	total
3 - 5	3	1	4	0	0	0	3	1	4
5 - 6	7	11	18	3	2	5	7	6	13
6 - 7	14	11	25	3	4	7	10	9	19
7 - 8	28	25	53	8	7	15	20	19	39
8 - 9	17	19	36	3	4	7	17	16	33
9 - 10	23	15	38	12	6	18	20	15	35
10 - 11	10	8	18	5	2	7	10	7	17
11 - 12	3	3	6	0	1	1	3	2	5
12 - 13	4	2	6	1	1	2	4	2	6
Total no. children	109	95	204	35	27	62	94	77	171
%children who recognize term				32.1	28.4	30.4	86.2	81.1	83.8
% of all children	96.5	96.0	96.2	30.9	27.2	29.2	83.2	77.8	80.1

Table 33

Explanations about why fat is eaten

n = 204

Age of child	Total no. exp'n	1 Fat as energy source	2 Oil	3 Use to cook food	4 Part of food	5 Fat people	6 Other
3 - 5	0	0	0	0	0	0	0
5 - 6	5	0	0	0	4	1	1
6 - 7	7	0	1	1	6	1	0
7 - 8	15	1	2	0	11	4	1
8 - 9	7	1	1	0	3	1	1
9 - 10	18	1	5	0	13	3	1
10 - 11	7	1	1	2	4	1	1
11 - 12	1	0	1	1	1	1	0
12 - 13	2	0	2	0	1	0	0
Total	62	4	13	4	43	12	5

The analysis of responses shown in Table 32 indicates that the pattern of responses is similar for all age groups although, as might be expected, the proportion of older children able to give examples of food containing fat was slightly higher.

In the pilot and trial studies six different categories of response were identified when children were explaining why fat was eaten (Section 4.4.6). As can be seen from Table 33 these categories were identified also in the responses in the interviews from 1988 to 1991. A further category of response, where fat was identified as a substance which is eaten and is a source of energy, was given by four of the children interviewed, all of whom were seven years or above. This response is one which forms an acceptable biological explanation of the function of fat in the body. These responses are of interest as they provide information on children's ideas about the relationship between fat and health, as well as clues to the effect of teaching:

"It gives you energy ... stored inside you, makes you fat..." (child 209, 7 years)

"Sort of substance to keep you warm. It is healthy in the winter. It comes in meat ..." (child 104, 8 years)

"... white substance on meat, keeps you warm, gives you energy. Too much is bad, clogs arteries."

(child 192, 9 years)

"... different forms of fat, oil ... keeps you warm but is bad for you and makes you fat."

(child 193, 10 years)

Children 192 and 193 were in a class which had studied 'Ourselves' in the previous term, a topic which had included study of 'sensible' diets and health.

The most frequent explanation given by children was of fat as part of food, for example:

"It's on bacon and it's all white and it's all wobbly"

(child 97, 6 years)

Forty-three of the children who gave explanations made statements of this type.

In many instances fat was regarded as unhealthy, or "bad for you"; twelve children associated the word with fatness in people. Child 192 quoted above was one of the few who mentioned specific diseases in relation to fat. A number of children, aged seven years or above, appreciated that we eat fatty foods, although they are regarded as unhealthy, because of their taste or because we like them:

"Fats, sugar are unhealthy but make food taste nicer."

(child 94, 8 years)

Some of the comments made were very perceptive, including that by child 77 mentioned earlier:

"If you fry food it isn't good for you, but if you like it, you want it."

(child 77, 8 years)

"Don't need to eat it ... some people like it."

(child 125, 8 years)

Only two children recognised that some fat was needed in the diet and that it was the amount of fat eaten which was important in determining whether fat was 'bad for you'.

The links between the ideas which children held and their own experience were evident, for example, D aged seven

suggested that:

"not every body eats fat ... when you go wrestling you keep getting fat."

The experience of cooking was important in enabling children, including five olds to distinguish between fat as something on meat and fat as something used in cooking.

The findings about fat are consistent with those of the pilot and trial studies. The links which children make between fat and health are also consistent with findings from research discussed in Chapter II, for example that by Wellman and Johnson (1982) and Reniscow and Reinhardt (1991).

4.8.2 Fibre

During the past decade the importance of fibre in the diet has gained prominence as part of nutrition education at all levels; the benefits of foods high in fibre have been stressed by health educators, manufacturers and media alike. For this reason it was perhaps not surprising that over fifty per cent of all children interviewed recognised the term, as can be seen in Tables 31 and 34 and Figure 39, and that sixty-two per cent of these could give examples of foods which contained fibre. Breakfast cereals were most commonly cited as foods as containing fibre; cereal packets were a frequently mentioned source of information about fibre and other nutrients. Vegetables, fruit and other cereal foods, such as wholemeal bread, were also cited as examples.

Table 34

Children's ideas about fibre

n = 212 (girls = 113; boys = 99)

Age of children	Recognition of word			Explanation			Examples of foods given		
	girl	boy	total	girl	boy	total	girl	boy	total
3 - 5	0	0	0	0	0	0	0	0	0
5 - 6	0	2	2	0	0	0	0	1	1
6 - 7	4	5	10	0	0	0	2	1	3
7 - 8	14	16	30	1	1	2	6	10	16
8 - 9	11	15	26	0	1	1	10	12	22
9 - 10	16	12	28	1	2	3	9	8	17
10 - 11	10	7	17	1	1	2	4	7	11
11 - 12	3	3	6	0	0	0	2	2	4
12 - 13	3	2	5	0	0	0	1	1	2
Total no.	61	62	123	3	5	8	34	42	76
% who recognise term	-	-	-	4.9	8.1	6.5	50.0	67.7	61.8
% all children	54.0	62.7	58.0	0.9	6.1	3.8	30.1	42.4	35.8

Table 35

What is fibre? Children's explanations 1988 to 1991

age of child	child code	Explanation about fibre	Examples of foods containing fibre
7.02	23	in cereal like fruit and fibre	Fruit and fibre cereal
7.08	186	"It's corn and it's been dried out; it's healthy ..."	cornflakes
8.04	16	"little things mixed with food ...good for you"	cereals with bran, 'Ready-brek'
9.10	35	"...goodness in food, important for health, gives strength ..."	vegetables, fruit, cereal
9.10	192	"...rough, cannot be digested, so you excrete it... good, cleans you out"	whole grain bread, cereals
9.11	1	waste out of food eaten, husk in cereal	cereal
10.00	193	tough like meat rinds, prevents constipation, "cleans tubes"	meat rinds
10.02	179	food with all the grains and seeds; linked to health and fitness.	grains, corns, fruit

Only eight children were able to give any explanation of what fibre was and/or its function in the body; the explanations given by these children are shown in Table 35. The statements by the two seven year olds provide examples rather than explanations; however, those by older children indicate some understanding of fibre and its function in the body. The responses by children 192 and 193 are of particular interest as they had studied aspects of diet in the previous term; the term 'cleaning out' had obviously had considerable impact! Fibre was always equated with health, a finding which is consistent with that of the trials and with the research by Reniscow and Reinhardt (1991) which was discussed in Chapter II.

Some children's ideas about fibre revealed both lack of knowledge and confusion. D, age seven, linked fibre to foods which were needed to keep us alive and:

"... eat things you don't like and lose weight" (117)
D's examples of foods containing fibre, for example chips, chip oil and apples, indicated general lack of understanding about fibre. For three children aged six and seven years fibre was equated with drinks and for two others the word fibre was equated with a 'fiver':

"...like it's some money" (child 148, 7 years)

The apparent general lack of understanding about fibre is worthy of comment as fibre is something which can be seen readily, for example grain husks or in vegetables. The findings suggest either that the children interviewed had limited experience of investigations of plant material containing fibre or that they have not made the connections

between such experiences and dietary fibre. In view of the perceived importance of fibre in the diet this area is one which merits further study.

4.8.3 Minerals

Tables 31 and 36 and Figure 39, show that the term mineral was recognised by fifty-seven per cent of all the children interviewed and half of these could give examples of foods containing minerals. For twenty children, one third of those who gave examples, the word was associated with mineral water, which could be expected in view of the growth in advertising and sales of that product in the past five years.

All but two of the fifteen children who attempted to explain what minerals were linked them to vitamins, for example:

"They are like a vitamin, a different sort of vitamin. I think they're good for you ... like mineral water."

(child 107, 7 years)

Only one child identified a specific element, iron, and his response indicated that his ideas were not entirely consistent with those of nutritionists:

"...little bits of things like iron ... you need some but not too many or you will go mad ... they're in fruit and vegetables and nuts" (child 68, 9 years)

Four children were certain that minerals were metals but the context of the task suggested that they must also be something to do with food, for example C. suggested that

Table 36

Children's ideas about minerals

n = 212 (girls = 113; boys = 99)

Age of children	Recognition of word			Explanation			Examples of foods given		
	girl	boy	total	girl	boy	total	girl	boy	total
3 - 5	0	0	0	0	0	0	0	0	0
5 - 6	0	2	2	0	0	0	0	0	0
6 - 7	4	4	6	1	0	1	1	1	2
7 - 8	16	12	28	2	1	3	4	4	8
8 - 9	13	13	26	0	3	3	9	10	19
9 - 10	17	13	30	1	3	4	7	10	17
10 - 11	8	7	15	1	3	4	3	4	7
11 - 12	3	3	6	0	0	0	2	1	3
12 - 13	3	1	4	0	0	0	1	2	3
Total no.	65	55	120	5	10	15	27	32	59
% who recognise term	-	-	-	7.7	18.2	12.5	41.5	58.2	49.2
% all children	57.5	55.6	56.6	4.4	10.1	7.1	23.9	32.3	27.8

minerals were "metal or things in food" which "kept us healthy" (120, 9 years).

Minerals were regarded as being beneficial for health by all those who gave explanations; one child was very specific about the value of minerals in the diet:

"makes you healthy and fit ... make your skin stay nice" (child 80, 10 years)

This statement may indicate confusion between minerals and vitamins rather than understanding of the function of minerals as such.

4.8.4 Protein

The word protein was recognised by half of those children interviewed, as can be seen from Tables 31 and 37 and Figure 39. Almost two thirds (63%) of these children could give examples of foods containing protein, for example meat, fish, beans, dhal. However, only ten children were able to provide explanations of what proteins were. Two of these (192 and 193) were in a class which had studied a food based topic in the previous term and they had been able to provide explanations of other nutrients, including fibre. In all cases the explanations linked protein with growth:

"It's food like cheese and meat, it makes you grow." (child 12, 5 years)

"...builds up your body, helps growth, need it for health, strength ...Helps build flesh." (child 193, 10 years)

Table 37

Children's ideas about protein

n = 212 (girls = 113; boys = 99)

Age of children	Recognition of word			Explanation			Examples of foods given		
	girl	boy	total	girl	boy	total	girl	boy	total
3 - 5	0	0	0	0	0	0	0	0	0
5 - 6	2	2	4	1	1	2	2	0	2
6 - 7	3	4	7	1	0	1	0	0	0
7 - 8	10	7	17	0	0	0	3	5	8
8 - 9	12	12	24	0	1	1	9	9	18
9 - 10	16	14	30	2	3	5	8	14	22
10 - 11	10	8	18	1	0	1	8	6	14
11 - 12	3	2	5	0	0	0	2	0	2
12 - 13	2	2	4	0	0	0	1	2	3
Total no.	58	51	109	5	5	10	33	36	69
% who recognise term	-	-	-	8.6	9.8	9.2	56.9	70.6	63.3
% all children	51.3	51.5	51.4	4.4	5.1	4.7	29.2	36.4	32.5

One child linked proteins with muscle development:

"... good for you, health ... gives you muscles
...cheese, milk..." (child 7, 9 years)

A further twenty-eight children suggested that proteins were 'good for you' or healthy. In some instances the examples of foods which these children gave, for example meat, indicated that they may have had some understanding of what proteins were, but in most cases these general statements appeared to be guesses related to the nature of the task.

Seven children linked protein to energy. One of these children also linked this idea to muscle development, the examples of foods given also suggested that he had a developing understanding of the function of proteins in the body:

"... kind of energy ...to build up body muscle ...
beans, fish." (child 156, 9 years)

A small number of children confused proteins with fibre or vitamins. Some ideas were particularly intriguing, for example the statement by a seven year old who said that proteins were needed:

"so poison don't get in - then we eat it."
(child 37, 7 years)

The nature of protein and the functions of protein in the body involve abstract concepts and it was therefore expected that children's understanding about proteins and their function in the body would be limited. The results are also similar to those found in the trial studies in 1987/88 which were discussed earlier. For the teachers

involved in the study the most important and telling finding was that only two children (192 and 193) from the classes in Years 4 to 7 who had studied a food topic which included work on proteins had any understanding about the importance of proteins in the diet.

4.8.5 Salt

Ninety-five per cent of children recognized the word salt and nearly three quarters (74%) were able to give examples of foods which contain salt or foods to which salt was added; details of the numbers giving responses are shown in Tables 31 and 38 and Figure 39. Thirty-nine per cent of all children who recognized the word were able to give some form of explanation; Table 38 indicates also that all age groups could give a reasonable working explanation of salt. Four categories of explanation could be identified:

1. Small white grains/crystals/powder (14)
2. Salt as small white crystals added to food during cooking or when eaten to give flavour (57)
3. Salt as a constituent of food (2)
4. Function in the body e.g. "water regulation" (6)

The number of children giving each type of response, indicated in brackets, shows that the majority considered salt to be something added to food to improve the taste:

"... makes things taste better" (child 37, 7 years)

"So imagine you're eating a food and it doesn't taste that right, we put salt on it to make it taste better." (child 114, 12 years)

Table 38

Children's ideas about salt

n = 212 (girls = 113; boys = 99)

Age of children	Recognition of word			Explanation			Examples of foods given		
	girl	boy	total	girl	boy	total	girl	boy	total
3 - 5	4	1	5	1	1	2	2	1	3
5 - 6	7	11	18	3	4	7	5	11	16
6 - 7	13	13	26	7	6	13	10	9	19
7 - 8	27	23	50	10	8	18	20	16	36
8 - 9	17	19	36	6	11	17	17	15	32
9 - 10	22	15	37	9	3	12	14	12	26
10 - 11	10	8	18	4	1	5	9	6	15
11 - 12	3	3	6	2	2	4	2	3	5
12 - 13	4	1	5	0	1	1	4	1	5
Total no.	107	94	201	42	37	79	83	74	157
% who recognise term	-	-	-	39.3	39.4	39.3	77.6	78.7	78.1
% all children	94.7	99.9	94.8	37.2	37.4	37.3	73.5	74.8	74.1

Only six of the seventy-nine children giving explanations recognized that salt had a function in the body. Four of these children related salt intake to health:

"if you have too much it makes you ill"

(child 110, 7 years)

Two children gave more specific responses:

"keeps body temperature right; too much is bad for you."

(child 192, 9 years)

"... water regulation in the body ... take salt if you sweat a lot ..."

(child 193, 10 years)

The last two responses are interesting as they come closer than any others to explaining the function of salt in the body; these children were two who had studied a food topic in the previous term (Table 24).

Salt was linked to sugar by children of all ages:

"It's like sugar but it's a bit sour" (122, 6 years)

"salt is similar to sugar but salt comes from the sea, just like sugar these crystalline things."

(child 114, 12 years)

Salt was apparently confused with sugar by nine children, for example:

"salt makes food sweeter." (child 103, 7 years)

"something put on dinner to make it sweeter."

(child 119, 9 years)

That such statements are made by children aged up to nine years indicates that this idea may be widespread. Further evidence for the confusion between sugary and salty foods came from the ways in which children sometimes placed crisps or chips in groups of foods which were otherwise sweet tasting; this type of grouping has been discussed

earlier (Section 4.6) and the implications will be examined later in Section 4.10.

Only five children made comments about whether salt was good or bad for them. Those children who did remark on the value of salt were either ambivalent or considered it bad for them, a view summarised nicely by one child:

"Salt is better than fat, but it's not that good for you, not like pepper." (child 32, 7 years)

On occasions children linked salt to its effects on specific parts of the body, sometimes in ways different from those given by the medical profession, for example:

"...it can be bad for you 'cos it makes your heart go too fast, wears it out and then you could die."

(child 116, 7 years)

Another child linked salt to tooth decay:

"Salt is not that good for you because it can spoil your teeth." (child 114, 12 years)

This last statement, which will be discussed in more detail in section 4.10, is perhaps another example of confusion with sugar.

The findings about salt are consistent with those from the pilot and trials discussed earlier.

4.8.6 Sugar

Only three children out of the 212 interviewed did not appear to recognize the word sugar, as can be seen in Tables 31 and 39 and Figure 39; these children included two children aged six and seven years for whom English was a second language. The majority (93%) were able to give

examples of where sugar was used, for example in tea or coffee, or as a constituent of, for example, sweets or cakes.

Just over a third (37%) of children were able to describe what sugar was and four categories of response were identified:

1. Description of sugar e.g. "Like snow but sweet"
(130, 8 years) (23)
2. White substance used as sweetener in tea or coffee or on foods e.g. cereal to improve taste (47)
3. Plant origins (4)*
4. Function in the body, linked to energy (6)*

* The response by one child fitted both categories:

"...a plant that you crunch to eat with different things. Gives you energy ...not very good for you."

(child 184, 8 years)

The numbers in brackets indicate the number of children giving each type of response. Details of the types of responses given by children of different ages are shown in Table 40 which shows that the majority of all age groups described sugar in terms of its uses. The numbers of those who described sugar simply in terms of appearance decreased with age. Only six children described sugar as an energy source in the body and no explanations of this type were given by children below the age of seven years. The explanations given by children 192 and 193, whose comments about nutrients were noted earlier, were the most sophisticated:

"...types of food that provide energy; you shouldn't eat too much as it's bad for you." (192, 9 years)

Table 39

Children's ideas about sugar

n = 212 (girls = 113; boys = 99)

Age of children	Recognition of word			Explanation			Examples of foods given		
	girl	boy	total	girl	boy	total	girl	boy	total
3 - 5	4	1	5	1	1	2	4	1	5
5 - 6	8	11	19	2	3	5	8	10	18
6 - 7	14	13	27	6	3	9	14	11	25
7 - 8	29	25	54	7	8	15	27	24	51
8 - 9	17	19	36	8	11	19	15	17	32
9 - 10	23	15	38	9	7	16	22	15	37
10 - 11	10	8	18	7	3	10	10	8	18
11 - 12	3	3	6	1	0	1	3	3	6
12 - 13	4	2	6	0	2	2	3	2	5
Total no.	112	97	209	41	38	79	106	91	197
% who recognise term	-	-	-	36.6	39.2	37.8	94.6	93.8	94.3
% all children	99.1	98.0	98.6	36.3	38.4	37.3	93.8	91.9	92.9

Table 40

What is sugar? Children's explanations 1988 to 1991

n = 212 (girls = 113; boys = 99)

Age of child	Description	To sweeten food	Plant source	Function in body	Health reason
3 - 5	0	2	0	0	0
5 - 6	2	3	0	0	2
6 - 7	5	4	0	0	4
7 - 8	4	9	2	1	5
8 - 9	4	12	2	2	5
9 -10	7	7	0	1	9
10 -11	1	7	0	2	2
11 -12+	0	3	0	0	0
Total	23	47	4	6	27

"...gives you energy, burn it off with exercise
...makes you fat, not good for your teeth."

(child 193, 10 years)

As Table 40 indicates a total of twenty-seven children made links between sugar and health, particularly the effects of sugar on teeth:

"little dots of white things ...bad for teeth"

(child 12, 5 years)

Some children identified the reasons for individuals eating sugar even when it was considered 'unhealthy':

"Sugar is unhealthy, but it makes food taste nicer."

(child 94, 8 years)

P's statement about why we eat sweet foods is equally perceptive:

"Sometimes we like sweet things." (119, 9 years)

The view of sugar as not being a 'proper food' was also mentioned:

"Sugar is bad for us... not proper food. We shouldn't eat it. ..in food that little uns like. Sweets, all kinds of food." (125, 6 years 10 months)

Some of the explanations for eating sugar revealed considerable misunderstandings, for example, D, suggested sugar was needed to:

"help us breathe, like trees." (117, 7 years)

This idea was one of those which really needed further exploration but which the teacher was unable to follow up at the time. D had a clear idea of what sugar was - "like salt" - and that foods such as toffee apples and sugar plums both contained sugar.

As was noted in the discussion about salt in section 4.8.5, children frequently linked sugar and salt and this was apparent in some of their explanations, for example:

"...bits of salt with flavour added, I have it all the time" (77, 8 years)

"...grains like salt" (8, 9 years)

"...like salt but sweeter ..." (81, 9 years)

Sixteen children, including one eleven year old also included crisps or chips in their examples of foods containing sugar, although not all of these included sweet foods in their examples of foods containing salt. Possible explanations for crisps being included with sweet tasting foods were discussed earlier (section 4.6) and will be returned to in section 4.10, which considers general issues of children's ideas about food and diet.

4.8.7 Vitamins

Tables 31 and 41, and also Figure 39, show that the majority (85%) recognized the word vitamin. Three quarters of the children interviewed were able to give examples of vitamins. For sixty-nine children (33%) vitamins were identified as vitamin tablets/pills; fruit and vegetables were identified most commonly as foods containing vitamins. A minority (10) identified specific vitamins, most commonly vitamin C; these children included five and six year olds.

Just over a quarter (26%) of the children interviewed gave some form of explanation as to why vitamins were necessary in the diet. Three categories of explanation could be identified, the number giving each type of

explanation is given in brackets:

1. Tablets/sweets taken for health reasons including prevention and cure (46)
2. Substances 'inside' food needed for maintenance of health (9)
3. Other e.g. energy source (1)

Vitamins were always equated with health or as being good for you. Even children as young as five years commented on the perceived links between vitamins and health as is shown by the five year old who said that vitamins were:

"orange flavour sweeties which make you better."

(90, 5 years)

Some children mentioned the importance of vitamins in curing infections and as a preventative measure, for example:

" for a cold or a coughs. So you don't get skinny."

(child 112, 7 years)

A further comment by this child raised questions about the power of suggestion in health:

"The homeopath gave me pills and she told me I'll feel a different person. I did feel like a different person."

Only one child attempted to link specific vitamins to their function in the body:

"need vitamins for body and teeth; it's sort of in foods; for teeth is D and A, mum has B and C for colds. Orange ... C, dhall ... A, sun ... D."

(child 155, 8 years, girl)

Table 41

Children's ideas about vitamins

n = 212 (girls = 113; boys = 99)

Age of children	Recognition of word			Explanation			Examples of foods given		
	girl	boy	total	girl	boy	total	girl	boy	total
3 - 5	2	1	3	0	0	0	1	1	2
5 - 6	5	10	15	3	3	6	3	7	10
6 - 7	11	8	19	6	2	8	5	7	12
7 - 8	26	20	46	8	8	16	26	16	42
8 - 9	16	17	33	4	6	10	14	16	30
9 - 10	21	15	36	6	2	8	19	14	33
10 - 11	10	7	17	3	1	4	9	7	16
11 - 12	3	3	6	2	1	3	3	3	6
12 - 13	3	2	5	0	1	1	3	2	5
Total no.	97	83	180	32	24	56	82	73	156
% who recognise term	-	-	-	33.0	28.9	31.1	84.5	88.0	86.7
% all children	85.9	83.8	84.9	28.3	24.2	26.4	72.6	73.7	73.6

The ideas which the children interviewed held about vitamins are similar to those identified in the pilot and trial interviews. The results are also consistent with those of Contento (1981) and Magaray et al (1986) which were discussed in Chapter II (section 2.5). Apparent differences between the findings, for example Contento found that a larger proportion of children considered vitamins to be pills/tablets, could be explained by sample size (Contento only interviewed thirty-four children) and by differences in practice, for example in consumption of vitamin pills, between Australia, the United States and England.

4.8.8 Carbohydrate and starch

The pilot and trial studies had revealed that few children recognized the terms carbohydrate or starch and in preparing for the interviews with teachers it had been suggested that they should only ask about these terms if they thought that it was appropriate to do so. For this reason few children below the age of seven were asked questions about either word and Tables 42 and 43, which indicate the numbers of responses given by children of different ages, do not include information about responses given by those younger than six years. Overall only one third of the children interviewed recognized the words carbohydrate or starch. Twenty per cent of those children recognizing the word carbohydrate were able to provide examples and all of these children were aged eight years or

above. The pattern for starch was similar, although a slightly larger number (30%) who recognized the word could give examples. Many of the examples of foods given appeared to be based on guesses although some children gave accurate examples; one child in particular was very explicit and apparently very knowledgeable:

"...modified starch and wheat starch, wheat flour..."

(163, 7 years, girl)

Very few children, as can be seen from Tables 42 and 43, were able to provide explanations about either term. Most of the explanations given were related to function, namely energy production, as can be seen from Tables 44 and 45, which list the explanations given by children of different ages alongside the examples of foods which they gave. The two children (1 and 128) who gave the most accurate explanations of carbohydrate were unable to give examples of foods which contained this nutrient.

The statements by the five children who gave explanations about starch varied; three were related to energy production, the other two were general statements which indicated some awareness of what starch was. All five were able to give examples of foods which contain starch.

The idea that nutrients were either 'good' or 'bad for you' was a recurrent theme. However, this idea was expressed less commonly in relation to carbohydrate and starch which may reflect the lack of familiarity with these nutrients. A small number of children asked questions about starch, for example child 119 who had recognized starch as a constituent of potatoes, asked:

"Is it good for us?"

(119, 9 years)

Some responses indicated confusion which were related to language, for example the response by child 120, talking about starch:

"Something to put in our turkey, might make it taste nicer" (120, 9 years)

indicates that she may have been thinking about 'stuffing' rather than starch.

Children on occasions linked the word carbohydrate to "a gas" (girl 9 years). The word was probably being confused with the term carbon dioxide which children had heard in connection with gases in the air or respiration. On two occasions it was related to dehydration. There are indications that the term carbohydrate was confused also with calcium, for example:

"It helps your teeth from decay. Makes our bodies strong, ... in milk" (120, 9 years)

Although starch is a substance which can be shown to children, what happens to it in the body is a difficult concept for children to understand, as are ideas about carbohydrates. Both terms appear on food labels and are likely to be used with increasing frequency as part of nutrition education as the value of carbohydrates in the diet becomes recognized more widely. The findings from these interviews, allied to those from the pilot and trials in 1987/88, indicate that the term starch may be an easier one for children to understand than carbohydrate. However, since the two words are not synonymous, the distinction between them is one which teachers may need to consider.

Table 42

Children's ideas about carbohydrate

n = 187 (girls = 101; boys = 86)

Age of children	Recognition of word			Explanation			Examples of foods given		
	girl	boy	total	girl	boy	total	girl	boy	total
3 - 5	-	-	-	-	-	-	-	-	-
5 - 6	-	-	-	-	-	-	-	-	-
6 - 7	0	1	0	0	0	0	0	0	0
7 - 8	9	3	12	0	0	0	0	0	0
8 - 9	7	5	12	0	1	1	4	0	4
9 - 10	7	10	17	0	2	2	2	3	5
10 - 11	8	3	11	0	0	0	1	1	2
11 - 12	2	3	5	0	0	0	1	0	1
12 - 13	2	0	2	0	0	0	0	0	0
Total no.	35	25	60	0	3	3	8	4	12
% who recognise term	-	-	-	0	12.0	5.0	22.9	16.0	20.0
% all children	34.7	29.1	32.1	0	3.5	1.6	7.9	4.7	6.4

Table 43

Children's ideas about starch

n = 187 (girls = 101; boys = 86)

Age of children	Recognition of word			Explanation			Examples of foods given		
	girl	boy	total	girl	boy	total	girl	boy	total
3 - 5	-	-	-	-	-	-	-	-	-
5 - 6	-	-	-	-	-	-	-	-	-
6 - 7	2	1	3	0	0	0	0	0	0
7 - 8	10	5	15	0	0	0	4	1	5
8 - 9	5	6	11	1	0	1	2	0	2
9 - 10	7	14	21	1	1	2	2	6	8
10 - 11	5	4	9	1	1	2	2	1	3
11 - 12	3	0	3	0	0	0	0	0	0
12 - 13	1	1	2	0	0	0	0	1	1
Total no.	33	31	64	3	2	5	10	9	19
% who recognise term	-	-	-	9.1	6.5	7.8	30.3	29.0	29.7
% all children	32.7	36.0	34.2	3.0	2.0	2.4	9.9	10.5	10.2

Table 44

What is carbohydrate? Children's explanations 1988 to 1991

n = 212

Age of child	Child code	Explanation	Examples of foods containing carbohydrate
8.00	128	"It has got a lot of energy, the body builds up carbohydrate" (word seen in classroom)	none given
9.07	68	"not sure, like sugary things, not sweet, can't see it, need some of it to help body"	chips, crisps, ice cream, sausages, fish, meat, eggs
9.11	1	"burn it off when you move ...calories"	none given

Table 45

What is starch? Children's explanations 1988/91

n = 212

Age of child	Child code	Explanation	Examples of foods containing starch
8.01	155	"for energy and stop being hungry; it's like pasta and potatoes I think."	pasta, potatoes
9.06	119	"something in food ... like potatoes."	potatoes
9.10	192	"sort of sugar, but it's better for you than sugar; does not turn into fat like sugar, gives you energy."	bread, cereals
10.00	193	"gives you energy; better to eat starch than sugar, burn it off better."	bread, wheat, cereal
10.11	58	"something to do with food, a bit like sugar"	seen on food labels

4.9 Why do we eat food?

"I eat food when my tummy rumbles. Grandad always burps at the end." (63, 6 years)

"We need food for our hair and teeth to grow, to make you work and give you energy." (174, 6 years)

"We need food so that we can live. In case we die of hunger." (110, 7 years)

The responses to the question 'Why do we eat food?' showed considerable variation as can be seen from the examples above. The responses could be divided into the three major categories which were identified in the trials:

1. positive reasons e.g. to keep us alive,
2. negative reasons e.g. "If we didn't eat we would die"
3. mixed response which included positive and negative reasons for example:
"To keep you healthy and keep you going. Like Ethiopia, if you don't eat any (food) you could die." (G. aged 9 years)

The numbers of children of different ages giving these responses is shown in Table 46 which indicates that children of all ages gave more positive responses than negative reasons and that mixed responses were least common. The responses given by children above the age of eight years tended to be more complex and this is reflected in the numbers of mixed responses shown in Table 46 for older children. The increasing complexity of responses is evident also when individual responses are analysed in detail, as can be seen from Tables 47 and 48 and Figure 40.

Table 46

Children's ideas about why food is eaten; summary of responses
1988/91

n = 212; 113 girls, 99 boys

Age of children	n =		Positive response		Negative response		Mixed response	
	girl	boy	girl	boy	girl	boy	girl	boy
3 - 5	4	1	2	0	2	1	0	0
5 - 6	8	12	4	7	3	3	1	2
6 - 7	15	13*	8	7	6	4	1	1
7 - 8	29	25	14	16	12	8	3	1
8 - 9	17	19	10	13	3	5	4	1
9 - 10	23	16	13	7	3	3	7	6
10 - 11	10	8	7	2	1	2	2	4
11 - 12	3	3#	1	0	1	1	1	0
12 - 13	4	2	1	2	2	0	1	0
Total number children	113	99	60	54	33	27	20	15
% children			53.1	54.5	29.2	27.2	17.7	15.2

Note:

* no response by one child

no responses recorded for two boys

Table 47

Why do we need food?

Analysis of positive responses given by children of different ages (1988/91)

n = 212: 113 girls, 99 boys

Age of child	Life		Growth		Energy		Str'th/stamina		Health/fitness		Hunger		Other	
	G	B	G	B	G	B	G	B	G	B	G	B	G	B
3 - 5	0	0	0	0	0	0	0	0	0	0	1	0	1	0
5 - 6	0	1	3	2	0	1	0	3	2	2	2	0	0	1
6 - 7	0	1	4	6	1	0	3	4	3	2	2	1	1	0
7 - 8	10	10	4	3	3	2	3	2	4	5	2	0	1	3
8 - 9	4	9	4	3	4	4	4	4	7	4	1	0	2	2
9 -10	10	6	5	3	1	4	5	8	7	4	2	1	5	2
10-11	6	3	2	1	1	1	1	1	3	4	0	0	1	1
11-12	0	0	0	0	0	0	1	0	0	0	0	0	1	0
12-13	0	2	0	0	2	0	0	0	0	1	0	0	1	0
Total	30	32	22	18	12	12	17	22	26	22	10	2	13	9
%	27	32	20	18	10	12	15	22	23	22	9	2	12	9

Table 48

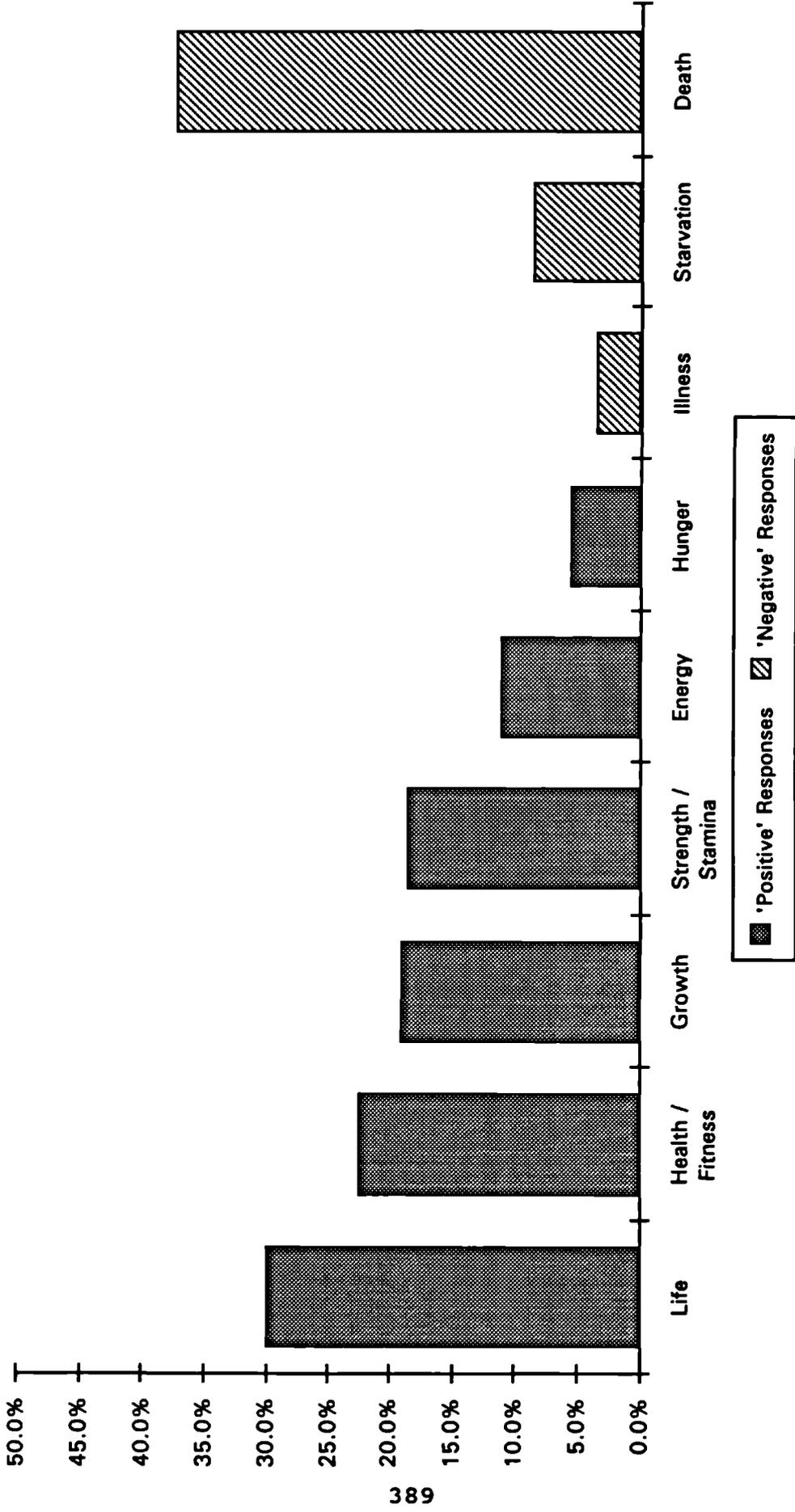
Why do we need food?

Analysis of negative responses given by children of different ages (1988/91)

n = 212: 113 girls, 99 boys

Age of child	Death		Starvation		Illness		Other	
	G	B	G	B	G	B	G	B
3 - 5	2	0	0	1	0	0	0	0
5 - 6	4	5	0	1	0	0	0	0
6 - 7	7	5	0	1	0	0	1	0
7 - 8	15	7	1	3	2	1	4	2
8 - 9	6	5	2	2	0	0	1	2
9 -10	7	8	2	2	0	1	1	1
10 -11	1	5	1	0	1	1	0	0
11 -12	1	1	0	0	1	0	0	0
12 -13	0	0	2	0	0	0	0	0
Total	43	36	8	10	4	3	7	5
%	38	36	7	10	4	3	6	5

Figure 40 Why do we need food? Children's responses 1988 to 1991
 n = 212



This finding is consistent with those from the trial interviews and appears to be related to children's intellectual development. Table 46 shows also that there was little difference in the numbers of girls and boys giving different types of responses.

The three main categories of response can be further subdivided. The positive reasons for eating food can be divided into seven main types of response, where food is needed for:

1. life,
2. growth,
3. strength and stamina,
4. health reasons,
5. energy,
6. satisfying hunger.
7. other.

Hunger is regarded as a positive response as feelings of hunger are a normal physiological response to a biological need. Those responses included in the last group (7) include general statements such as "to keep you going". Table 47 shows the numbers of children giving these types of responses. General statements about life were the most common but more specific statements about, for example health and/or fitness were also frequent. The types and numbers of different responses given by girls and boys were similar, although more girls specified hunger as a reason for eating!

The negative reasons which children gave can also be subdivided:

1. death ("without food you would die"),

2. starvation,
3. ill health,
4. other e.g. "bones go rotten".

The number of children giving each type of response is shown in Table 48 and Figure 40. Death was the most frequent response. The number of children in each age group is relatively small and therefore it is not possible to discern patterns in the responses in relation to age. The number of girls and boys giving each type of response was very similar.

The findings from this activity, including the categories of response, were very similar to those of the trials discussed earlier in section 4.4.7. The patterns of response are similar to those of Magarey et al (1986), which was discussed in Chapter II, which showed little difference in responses between children of different ages to two questions:

1. Why do we need food?
2. What happens if we don't eat food?

The activity described in this section, on the reasons for eating food, could have been extended by further questioning to probe what children understood about, for example energy. There were very few instances where teachers did question children further for which there were two main reasons. In the first place the answer to the question was often given as part of discussion when it was inappropriate to discuss the comment in depth. Secondly, if the question was posed at the end of the interview, the children were tired or time was short.

Questions about children's understanding of the term

energy, in particular, could have revealed the range of understandings of this concept, a concept which is of fundamental importance in science. The work of Gosden (1987) and Brook and Driver (1984), which was discussed in Chapter II, provides evidence of the ideas about energy which children hold which are at variance with those of scientists. Neither Gosden nor Brook and Driver investigated what children said about energy in relation to food, although Gosden's work with primary school children indicated that children as young as five years associated the word energy with food. What is of note in the findings from the interviews described in this chapter is the relatively few times that energy was mentioned when children were talking about the reasons for eating. However, this finding is consistent with those of Magarey et al (1986) who found that only six per cent of children in their sample of forty-eight ten year olds mentioned the term energy when giving reasons for eating. Ideas which children hold concerning the concept of energy in relation to food is something which appears to require further study.

4.10 Children's ideas and knowledge about food and diet

The reports by teachers yielded further information about children's ideas and understanding in addition to those which have been analysed in earlier sections in relation to food grouping, meal choices and nutrients. There were three areas in particular which emerged from the reports by teachers which related to understanding in

relation to aspects of food and diet namely:

1. diet and health,
2. the importance of variety and balance in the diet,
3. "alternative frameworks".

The emphasis in science education research on the ideas which children hold which are at variance with the ideas of scientists was discussed earlier in Chapter II. The studies reported by Osborne and Freyberg (1985), which include investigations with children between 5 and 11 years, was used as background reading by the teachers and helped to alert them to the range of ideas which might be held about specific scientific concepts. The use of the term "alternative frameworks" is preferred to "misconceptions" as it acknowledges the importance of the different, rather than incorrect, ideas which children may hold.

4.10.1 Diet and health

The findings indicate that children as young as five and six years have considerable knowledge concerning diet and health. Although only three children below the age of seven years spontaneously grouped foods into healthy or unhealthy groups, children of all ages frequently commented on foods chosen for meals or snacks as being "good for you" and sometimes explained that they liked particular foods but were not permitted these as they were not good for them. Those children who did group foods as being healthy or unhealthy made selections which generally accord with current views of health, as can be seen from Tables 22 and

23. Thus, foods containing sugar and fat are considered 'bad for you' and those containing fibre and vitamins are 'good for you'. The groups of healthy food items may contain foods which are liked rather than ones which are intrinsically 'healthy'. Those few children who recognized terms such as starch or carbohydrate considered them to be healthy but their responses may have reflected their perception of the nature of the task rather than indicating real understanding. Cheese was the only food item high in fat which was categorised as healthy.

Some six year olds appear to understand that specific nutrients, notably fats and sugar, are related to health, as is revealed in the following transcribed conversation with a six year old girl who is unable to explain why we eat sugar:-

T. "Do you know why we eat sugar?"

E. "BecauseIt's not good for you... It's not very good at your teeth."

Older children are able to articulate their ideas more clearly, for example one nine year old talking about sweet things said "we should only eat these in small quantities". Another child, also aged nine years, chose a selection of sweet foods and crisps as snack foods and then said:

"They make my teeth rotten."

The values attached to particular nutrients is of relevance for health education. The idea of vitamins as tablets/pills was widespread; a third of the children interviewed described vitamins in this way.

The small number of children who attempted to explain

what minerals were linked them to vitamins:

" They (minerals) are like vitamins, good for you"

(child 27, 7 years)

was a typical response.

Some comments revealed the recognition that certain foods were eaten because of the taste although children realised that such foods were unhealthy, as is illustrated by the girl who said that fats and sugar were:

"unhealthy, but make food taste nicer." (94, 8 years)

Some children understood also that the way in which food was cooked affected whether it was healthy or unhealthy, for example the comment mentioned earlier:

"If you fry food it isn't good for you, but if you like it, you want it." (child 77, 8 years)

This remark is particularly significant as it reveals considerable understanding of the reasons why individuals choose to eat particular foods, even when that decision is at variance with their knowledge of diet and health. Food choice is governed by many factors, of which knowledge is only one.

When children categorised foods, they grouped them as either good/healthy or bad/unhealthy. Very few indicated that they understood that it was the amount of certain foods which was important in determining whether or not they were 'good' or 'bad'. The comment by one child that,

"some good foods have fats in them." (64, 10 years)

indicated a far greater understanding than most.

4.10.2 Variety and balance

The children's recognition of the need for variety and balance in the diet was apparent from some of the transcripts and this was commented on by some teachers:

"They (6 year olds) also seem to have appreciated the need for variety in the diet, as this is reflected in their meal choices."

The idea of 'balance' was evident from comments such as that by a nine year old talking about choosing supper:

"I need protein, vegetable and fibre. I like all these."

The notion of balance was normally linked to ideas about an individual needing certain amounts of different foods. The word balance itself was used spontaneously by only one child, a ten year old who commented that fibre is:

" good for balance" (child 64, 10 years)

What was meant by balance in this particular case was not clear, but it was probably linked to the ideas concerning a variety of foods in the diet.

4.10.3 Alternative frameworks

The range of ideas concerning nutrients, which was discussed in section 4.8, provided an indicator of the alternative ideas held by children. Ideas concerning vitamins as tablets, or minerals as mineral water, were widespread amongst all age groups. Where children attempted to explain what was meant by terms like protein, carbohydrate or starch it was apparent that most had only

hazy or confused notions of these nutrients; the ideas which they had about these nutrients were discussed earlier. Some ideas were particularly intriguing, for example the description of proteins being needed:

"so poison don't get in - then we eat it."

(37, 7 years)

The confusion of the term carbohydrate with a gas or dehydration was discussed in section 4.8.8.

There were, however, other areas where children's ideas were at variance with those of scientists/ nutritionists. These ideas were revealed in the transcripts and commented upon by teachers, who related the children's ideas both to their own experience and the work of others, in particular that reported by Osborne and Freyberg (1985).

A particularly interesting finding, which was commented on in earlier sections, was the inclusion of crisps, and more rarely chips, in food groups designated as sweet and otherwise only containing only sweet tasting foods, such as cake, sweets or ice cream. Some children also included crisps amongst their examples of foods which contained sugar. The children in the pilot study who included crisps amongst a group of foods which were otherwise all sweet tasting explained that they were doing so because crisps and sweet foods were both unhealthy. Groupings of this type by other children could also be explained in this way, even when individuals did not articulate their reasons. The idea that sweet things were not good for them was frequently commented upon as was recognition that people ate sweet things because they liked them. A further explanation could be that crisps and chips are being linked to the concept of

'nice tasting'. Sweets are 'nice' therefore other foods also considered as nice, or favourite foods, such as crisps tended to be categorised as sweet.

There did appear to be other reasons for the inclusion of crisps with sweet foods. One reason may be linked to the properties of food, such as taste, and children's use of language, as is highlighted by the six year old who revealed that her concept of 'sweet' was not that of her teacher. Her teacher commented:

"During a tasting experiment M. may have described a certain food as being sweet. Because she would be using an acceptable term I would have assumed that she meant something tasted sugary. However as a result of the interviews I know that she may not mean that at all."

It is possible that some children may find it difficult to distinguish between what is a salty taste as opposed to a sweet taste. Some children, particularly those for whom English is a second language, may lack understanding about the meaning of the words being used; this explanation may well apply to the twelve year old who included crisps in her group of sweet foods.

There is some evidence that part of the reason for the confusion between sugar and salt may be linked to the perceived similarities in appearance between salt and sugar, as well as their properties, for example in improving the taste of food. These links were clearly articulated by one twelve year old:

"Sugar, it's like salt, this sort of salt looks like tiny crystals and they're in different types of food...(child 114)

This child went on to say that salt was:

"similar to sugar but salt comes from the sea, just like sugar, these crystalline things. Salt is not that good for you because it can spoil your teeth ...if you are eating food and it doesn't taste right we put salt on it to make it taste better."

In this instance the notion of salt being bad for your teeth may be related to ideas derived from health messages which make links between sugar intake and dental caries.

The evidence concerning children's ideas about salt and its importance in the diet, the linking of crisps, and to a lesser extent chips, to sweet tasting foods indicates the importance of teachers being alerted to the range of children's ideas about nutrients, including salt and sugar.

4. 11 Skills and learning

The food grouping and food choice activities involved children practising skills which are regarded as important in science education (DES, 1983; 1985; 1989), for example, the ability to classify and to recognize similarities and differences. The ability to group items and to discriminate between them is fundamental if children are to be able to group foods, or to make food choices based on understanding of the role of different foods in achieving a healthy diet.

4.11.1 Classification

Sorting objects into sets is a common activity at all stages of primary education, particularly in mathematics. The majority of teachers, including those working with infant classes, indicated that when they began the first activity with the children they felt confident that pupils would have no difficulty in placing the pictures of foods into groups as a result of their earlier experience of grouping objects into sets. In many instances this activity revealed that even some eleven year olds found this grouping activity problematic, but not because they were confused by the cards themselves or the number of cards involved. Children below the age of seven were more likely to find the task difficult. There are a number of possible explanations for the difficulties which pupils appeared to experience.

The first explanation is that children found it difficult to transfer the skills that they had gained elsewhere to this new situation. The second explanation relates to the use of pictures rather than food items for the task. Support for this explanation comes from the work of one teacher in a nursery class. The three children she interviewed, whose ages ranged from 3 years 10 months to 4 years 5 months, were much younger than any other children interviewed. In the original interview all three children had shown limited ability to use the cards to form meaningful groups. Two weeks after the interviews she tried the activity again using real objects, as near to the

cards as she could manage. The results, as she reported, were completely different:

"This time they sorted the fruit into one pile, the vegetables into another, the bottles were put together and the remaining items which they were not sure about they left in a pile..."

The implication was that all three children:

" had the knowledge of food groups, but without concrete objects (which is their normal means of sorting) there appears to have been a mismatch in their ability and understanding of the task required of them."

This finding indicates that the results from the interviews must be interpreted with caution, particularly where children are operating at the pre-operational level.

The sometimes unexpected or random groupings which children make can be interpreted, however, as common sense views of foods which can, or are, eaten together on specific occasions. Thus a grouping which includes milk, apple, bread and sweets, could be eaten together as a snack. When some teachers studied pupils' food groupings in more detail what seemed at first to be random groupings appeared to have a logical explanation, even if none had been given by the child.

The choice of food items also affected the outcomes, for example children often found nuts difficult to group. This observation is consistent with those made by the author in the pilot study. The responses by some children indicated that they were working towards understandings of

particular forms of classification, for example,

"To begin with D. (10 yrs), having decided on categories for fruit and vegetables, had difficulty in deciding to which of the two groups certain items belonged. Strawberries and walnuts, for example proved difficult to group and, although beans were correctly classified, his comment:

D. 'We've got beans. That's a fruit. Comes from a vegetable.'

showed confused thinking.

D. grouped corn* with the vegetables 'because it comes from the vegetable patch'." (RSC)

* maize

If children are experiencing difficulty in grouping objects, including food items, it could be that some, if not all, pupils require not just more experience of placing objects in groups or sets, but more varied contexts in which the activity can take place. The introduction of the National Curriculum in science (DES, 1989) provides both contexts and opportunities for developing understanding of set theory which is fundamental to certain aspects of science, for example biological classification. The need for continuing experience which builds on and extends skills developed earlier is essential, a point made clearly by one teacher:

"...all too often we forget the importance of skills concentrated on in the early stages of learning instead of employing those very skills such as sorting and classifying and extending them. Valuable time set

aside in the infant classroom for free exploration is often lost in later years." (LHC)

Some teachers provided suggestions for ways in which children's understanding of classification could be developed. One teacher, commenting about a six year old, wrote :-

"Her sorting experience (i.e. prior experience) must be limited to sorting into groups which are the same rather than into groups whose elements are different but have a common link." (ALD)

Other teachers provided examples of activities which could be used:

"We could make a collection of all the items they have grouped as vegetable or fruit and compare the items in each group. How are they different or similar?"

The author considers that the ability to group items and to discriminate between them is fundamental for grouping foods and making food choices. The development of such skills should therefore be regarded as an important part of nutrition education programmes. Activities of the type identified above have a vital role to play in the development of such skills.

4.11.2 Identifying similarities and differences

Information about children's ability to perceive similarities and differences between objects and groups of objects in science comes from the Assessment of Performance Unit (APU) in their report of their study of eleven year

olds in 1981 (APU, 1981). The results of the APU investigation indicated that differences between objects were more readily identified than similarities.

The findings of teachers in the present study were similar to those of the APU. One teacher in reporting on the interviews with a group of eight to nine year olds wrote:

"The children (8-9 years) seemed to realise that some foods could fit into several groups and the group they finally selected was not always the most useful...

"The children at their stage of development found it difficult to decide exactly which were the important similarities e.g. P's chicken would have been more appropriate in the "cooked group" than in the "grocery group" which was otherwise all fruit and vegetables."

(BFC)

That differences are more readily identified than similarities, has implications for science education generally and for nutrition education in particular. When grouping food items, choosing meals or discriminating between 'healthy' or 'unhealthy' foods it is necessary to be able to recognise both similarities and differences.

Many teachers in their reports commented that they now appreciated the need to provide children with more opportunities to look for similarities, as well as differences.

4.12 Teachers' ideas about food and diet

As was indicated in Chapter III, the DES in its proposals for the 35-day and 20-day programmes for curriculum coordinators in primary science, emphasised that an important element of such courses should be the updating and extension of teachers' own scientific knowledge (DES, 1983; DES, 1990). The research study described in this and the previous chapter had a part to play in this process by providing teachers with opportunities to learn more about food and nutrition.

The questionnaire used at the start of the research programme (Appendix IX) was one way in which the knowledge that teachers already held could be identified. The most important function of the questionnaire, however, was to stimulate discussion and debate about food and nutrition, including teaching approaches, and this purpose influenced both the form of the questionnaire and the purposes for which it was used during the course. The questionnaire included questions about teachers' own understanding as well as teaching strategies; teachers were also invited to record any questions which they wanted to ask about food. Summaries of the responses given by each group were prepared by the author and used as a basis for promoting discussion and for developing teaching; an example is shown in Appendix X.

Further information about teachers' ideas came from the questions which they raised, which are discussed in section 4.12.4, from comments which they made in their

reports following the interviews with children, which are considered in section 4.12.3, and from reports on teaching which are discussed in Chapter V.

Although no formal evaluation was made of the knowledge which they gained during the course, teachers reflected on what they had learnt by writing brief comments at the end of the course. In 1990/91 teachers completed a post-interview questionnaire, identical to that used at the start of the programme; the results from this questionnaire are discussed in 4.12.2 below. In all cases written responses were anonymous.

4.12.1 Analysis of pre-interview questionnaire.

The first part of the pre-interview questionnaire included questions about teachers' own understanding about diet and health and food choice. This section contained two items which were related directly to questions which teachers would ask children during the interviews, namely why food is eaten and what food grouping systems they used normally. Individuals were invited also to write down questions which they wanted to ask. The responses to the questionnaire were used as a basis for introducing the research study and to stimulate discussion on the subject of food and nutrition.

The second part of the questionnaire invited teachers to indicate how they would teach a food based topic and to indicate which ideas, in their experience, children found difficult to understand. This part of the questionnaire

was used in planning for teaching and as a starting point for discussion in workshops related to food and nutrition, which formed part of the course.

Appendix X, which is based on a summary of the responses made to the questionnaire by teachers in January 1990, reflects the range of responses given by teachers throughout the period of the study from 1988 to 1991. Teachers came to the course with a great variety of expertise and experience and this was reflected in their responses.

As can be seen from Table 49 the most common response (65%) to question 1, 'What is food?', made reference to material of plant or animal origin required to maintain metabolic processes. Nearly a third of respondents mentioned food as an energy source. Many people gave responses which covered more than one category; simple statements such as "Food is anything I eat" were rare. Most of the responses indicated considerable understanding of what constitutes 'food'.

The types of responses to the second question, 'Why do we need food?' are summarised in Table 50. The responses were often very detailed, with individuals mentioning more than one of the categories listed in Table 50. Energy and/or maintenance of the metabolism was the most frequent response, although growth was mentioned by forty-four per cent of the teachers, some of whom described growth at cellular level. The responses provide an interesting contrast to those given by children (which are summarised in Table 46) where energy was mentioned by only eleven per cent of the children.

Table 49

Why do we need food? Summary of teachers' ideas 1988 to 1991

n = 70

Reasons	% responses
Energy/metabolism/"fuel"	65
Growth/replacement of tissues	44
Life/survival	31
Maintenance of health	25
Source of essential nutrients	6
Hunger	2
Other e.g. pleasure,taste	2

- **Note** Some respondents gave more than one reason

Table 50

What is food? Summary of teachers' ideas 1988 to 1991

n = 70

Reasons given	% responses
Edible material of plant or animal origin needed to maintain metabolic processes	65
Energy source/fuel	31
Substances containing nutrients	15
Substances needed to prevent disease/maintain health	8
Growth	8
Satisfy hunger	6

Note Some respondents gave more than one reason

The most frequent response to the question about a 'healthy diet' involved the use of the word balance. In this case the term was used to describe the amount of different nutrients required to maintain health; two thirds of teachers gave this type of response. A further twenty-seven per cent described a healthy diet in more general terms as one which ought to be eaten.

The factors which were identified as governing food choice are listed in Appendix X. Personal preference was the most commonly mentioned factor (64% of responses), with health reasons (49%) and price/income (39%) being the next two factors identified. Interestingly, hunger was identified by only one person and the media and advertising received no mention.

In responding to question 5, which concerned food groups, a number of teachers pointed out that the type of grouping system that they would use would depend on the context, for example teacher or cook. Fifty per cent of teachers identified a nutrient grouping system. A further forty-eight per cent mentioned a system based on foods, for example fruit and vegetables, dairy foods; this system was also the one which most teachers identified as one which they would use with children.

The responses to the questions about teaching about food were very varied. The range of starting points identified provided an excellent basis for discussion of planning for teaching later in the course. The food groupings which teachers used with children were reassuring in many respects; the majority of teachers used a food

based system, only ten teachers cited a nutrient based scheme (they all worked in junior or middle schools).

4.12.2 Post-interview questionnaire

After interviewing children and writing their reports teachers were invited to record what they considered to be the most important learning outcomes for them as individuals; they also completed a post-interview questionnaire which was identical to that completed prior to the interviews.

The learning outcomes could be grouped into two areas. First, increased knowledge and understanding about nutrients and health and, secondly, issues related to children's understanding about food and nutrition. Most teachers specified that they felt they knew more about food and diet as a result of conducting the interviews; the exercise had helped them to identify what it was they needed to know. They considered that the activities had helped them in teaching, by alerting them to the range of ideas which children held and in developing a wider range of teaching strategies; these issues were considered in section 4.11 and will be returned to again in Chapter V. The biggest difference between the responses to this questionnaire and the earlier one was that all the teachers now specified that they would elicit children's ideas prior to starting work on the topic of food (or indeed any other topic).

4.12.3 Teachers' analysis of their own knowledge and understanding

Many of the teachers, in describing the interviews with their pupils, indicated that they themselves had learnt more about food and diet as a result of undertaking the activity. The written reports rarely included details of what teachers themselves had learnt, although individuals often commented in general terms. The types of comments made in the reports relating to individuals' own knowledge are exemplified by the following:

"In doing the tests I realised how much I didn't know about food!"

"I realised how limited my knowledge of food was, together with what we need and why."

The written reports and comments made in sessions at the Institute provided evidence that teachers recognised that the very nature of the activity had caused them to review their own ideas and understanding about aspects of food and diet. Some indicated that they now had greater awareness of what was meant by 'healthy eating' including linking excess or lack of nutrients to specific health disorders. The activities also gave teachers greater insights into the ways in which the media influenced their thinking and that of their pupils, for example:

"I realised not only that my own knowledge, particularly regarding starch and minerals was limited but also the extent to which I had been influenced by the media. Indeed I placed the same values on fats, salt and protein that the children appeared to do."

Some teachers expressed surprise at the level of children's awareness of health and diet in relation to their own:-

"I also discovered that my own choices of food for meals would not, subject to similar analysis, produce very different comments from the children's."

This remark is significant. It reflects our common experience and can be linked to the constraints, including the social, economic, cultural factors, which influence our choice of food in the same way as the children we teach.

Specific comments about food and diet arose mainly during group discussions, both prior to and after the interviews, which led to individuals raising questions that they wanted answered about food. The questions related to the knowledge implicit in all four activities which were undertaken with pupils.

4.12.4 What do teachers want to know about diet and health?

The types of questions raised by teachers prior to the interviews with children are shown in the summary of the questionnaire responses in Appendix X. The questions were related to three areas of food and nutrition:

1. nutrients and food constituents,
2. food and health,
3. food production.

These questions were used as a basis for discussion and activities later in the course, for example the CHATTS

project mentioned in Chapter II which helped teachers to think through and consider ideas about food irradiation.

After completing the interviews and writing about them many of the teachers still had questions; some related directly to the work undertaken with the children, for example:

"Do we need fat in the diet? How much do we need?"

"Why do we need to eat salt?"

"What is 'organic' food?"

"Are additives harmful?"

Some questions related to issues which were being debated in the media at the time we were working, for example:

"Do egg whites contain Salmonella?"

"What food is not safe to eat?"

"What is the link between cholesterol in the blood and consumption of fatty foods?"

"Are microwaves safe to use?"

Other questions were of a more general nature:-

"What is the effect of advertising in promoting particular foods?"

These questions indicate areas where teachers have concerns which are common to many people outside the scientific community as well as specific questions about nutrients in the diet and their importance in body metabolism. The questions were a means of identifying specific issues which required further study and were used as the starting point for teaching and debate during the course.

4.13 Summary

This chapter has considered the findings from the interviews with children in some detail. Although the number of children interviewed is relatively small, and therefore the results cannot be regarded as statistically significant, there are patterns in the findings which are consistent over time and amongst different age groups. The author considers these patterns to be important and to have implications both for teaching and for the development of policies in nutrition education.

The findings from the interviews indicate that the majority of children, when allowed to group foods independently, use a form of classification but that it is rarely related to nutrients. The classification system chosen is based largely on vegetables and fruit, plus meat and 'sweet' foods. This system was sometimes extended by children above the age of eight years who had been taught about cereal or dairy groupings. A classification system was frequently used in conjunction with other systems.

The findings suggest that a system of grouping which builds upon children's ideas and extends their understanding of classification is a sensible starting point. Such a system is consistent with recommendations on diet and health from, for example, the World Health Organisation (1990). The author suggests that food grouping based on nutrient classification is inappropriate for children below the age of twelve years.

All the children interviewed, with the few exceptions

of children below the age of seven for whom English was a second language, understood what constituted a meal and could distinguish between a meal and a 'snack'. Children's comments on their choices of foods indicate that most chose foods they would normally eat and/or liked. For the children interviewed it appears that meals are a common part of their experience, as are snacks. This finding may seem obvious but should be compared with the evidence from the national survey on the diets of British Schoolchildren (Department of Health, 1989) which points to the move towards 'grazing' habits amongst secondary school pupils in particular.

The majority of children of all ages have heard of sugar, salt and fat; most have also heard of vitamins. Other terms such as fibre are more rarely recognized. Although children can often give examples of foods which contain sugar, salt and fat less than forty per cent can explain what these substances are, only a very small number could describe their function in the body; for other nutrients the percentage was much smaller. This lack of understanding is not unexpected in view of findings from earlier research about children's understanding of what happens to food in the body, for example that by Gellert (1962) and Wellman and Johnson (1982) which was discussed in Chapter II.

A number of alternative ideas emerge which are unexpected and/or different from the understandings held by scientists. These ideas include apparent confusion between foods containing sugar and salt by younger children and the

notion of vitamins as tablets. Possible reasons for such ideas have been examined, including children's use of language and prior experience.

The findings about nutrients indicate that there are a number of issues which need to be addressed by teachers and schools as well as policy makers. Teaching about abstract nutrient terms, the author suggests, is not appropriate; however, it is possible to give children more experience of using and investigating the properties of substances such as salt, sugar, fat and fibre which are part of their everyday experience. Such experiences should be planned carefully to take account of the ideas which children hold and also to ensure continuity and progression from Years 1 to 7. A further issue which needs to be addressed is that of the values attached to food.

The majority of children have very clear ideas about which foods are healthy and which are unhealthy. Their understandings about such foods are generally in broad agreement with those of nutritionists although for some children the lists of healthy food items may contain foods which are liked rather than ones which are intrinsically 'healthy'. For those children who characterised foods in terms of health sugar, fat and to a lesser degree salt were regarded as unhealthy. Vitamins, fibre, plus minerals and proteins are all 'good for you'. Those few children who recognized other terms, including starch, considered them to be healthy but their responses may have reflected their perception of the nature of the task rather than indicating real understanding.

For teachers there are clear messages which emerge from these views about healthy/unhealthy foods. One of these is the importance of promoting positive attitudes to food and specific nutrients in order to prevent anxiety or guilt. The recent emphasis on enjoyment of food in government publications (DoH, 1991) supports such approaches. Helping children to consider their reasons for choosing specific foods is important. We need also to help children to come to terms with the fact that certain foods are necessary components of the diet, although if eaten in excess they may lead to increased risk of ill health in the long term; this is not easy. We have to acknowledge and to accept that sweet foods are almost universally liked and are popular. Family and peer group experiences are amongst the many factors of which account must be taken when teaching about sweet foods.

A further element of the results discussed in this chapter has been the way in which teachers' own understanding about food and nutrition developed during the research study. The ways in which the interviews, and related activities, helped teachers to reflect on their own ideas have been identified. The apparent increase in teachers' knowledge and understanding and confidence cannot be ascribed simply to the research programme; they have to be viewed in the context of the whole course programme which was described in Chapter III.

The findings from this study, although valuable, indicate that teachers discovering more about children's ideas is only a first step in helping children, and

teachers, to develop greater awareness of what they are eating and how food is related to health. What happens in the classroom is only one element of nutrition education within the health promoting school. There is a need also to recognize the importance of the different influences which impinge on the nutritional career of the individual, in particular the role of the family. The study indicates that for most children from 5 to 12 years what they actually eat, and like to eat, is food normally eaten at home. Friends, the media and the medical profession also have some effect on what they eat.

The implications of the findings for the teachers who participated in the study, for the schools in which they worked and for curriculum and policy development in nutrition education, will be considered in the following chapter.

CHAPTER V

Developing strategies for teaching - outcomes and prospects

5.1 Introduction

If the findings discussed in the previous chapter are to be of value in curriculum development in nutrition education it is evident that they must be applicable to both the individual teachers who engaged in the research and the wider school community, including other teachers and health educators generally. This chapter starts by examining the outcomes of the research for the teachers involved and then considers the implications for the schools in which they worked and for the wider school community, including INSET providers.

Information about the impact of the research on the practice of teachers came from a number of sources. The first of these sources was the reports which they wrote about the interviews with children, which included reflective discussion about the possible implications of their findings for teaching science and health related topics. Individual and group discussions following the interviews also highlighted changes which had occurred in the nature of teachers' thinking about approaches to teaching food based topics. In 1990 - 1991 a post-interview questionnaire was included as part of the discussion in which teachers were asked about the strategies they would

use for teaching food based topics in future. Evidence about actual classroom practice came from reports on teaching science which teachers undertook on their courses in the period following the interviews; these reports contained details of teaching strategies, ways in which the progress of pupils were monitored and assessed and work undertaken by pupils.

The majority of the teachers on the Diploma in Primary Science Education and Coordinators for primary science courses had responsibility for science in their schools. The role of the coordinator frequently includes supporting other teachers in their classrooms, running school INSET programmes as well as developing and promoting school policies for science. Coordinators are thus in a position to act as agents of change in their schools.

Ways in which links can be made between schools and the wider community were discussed in Chapter III (Section 3.3) where attention was drawn to Figure 27 which summarizes discussion which took place at an international meeting held in Bangalore in 1985 (Harlen, 1985). The networks shown in this figure indicate the types of links which could be developed between schools and the wider community. The local networks which were created in some LEAs during the late 1980's by advisers, and sometimes by coordinators themselves with the support of advisory teachers for science, reflect the type of networks envisaged at the Bangalore meeting. Such networks are a further way in which change in educational practice can be effected.

The period during which this research took place was one of rapid change in primary schools as the National Curriculum for England and Wales (DES, 1989) was introduced. Science, technology, and health education all feature as important elements of the curriculum for 5 to 16 year olds. All these subjects have been identified earlier (please see Chapter I) as areas of the curriculum where nutrition education may take place. A particularly significant aspect of the National Curriculum is that which pertains to assessment (DES, 1988; DES, 1989), with assessment of science featuring as part of both teacher assessment and Standard Assessment Tasks (SATs) for seven and eleven year olds. The development work on assessment for seven year olds, Key Stage 1, formed a backdrop to this research with the piloting and trials of SATs in 1989 and 1990 and the first national, unreported, assessments in May 1991. For primary teachers the assessment of science is a new, and very stressful, part of their role. Teachers engaged in the research project frequently considered the importance of the interviews in the context of assessment, which could be related to concerns about assessment of science in general. The role of the research procedure and the implications of the findings for assessment are therefore considered separately.

5.2 The teacher as reflective practitioner

The idea of the teacher as reflective practitioner was raised in the Introduction. The author indicated the

importance of teachers developing in ways outlined by Schon (1983, 1987), who described the professional as someone who uses reflection as a means to improve their practice.

That the idea of teachers reflecting on practice was not new was also discussed and attention was drawn to reports which have considered teacher education and practice, including the James Report (DES, 1972), which have made links between such reflection and research.

One of the purposes of the research programme was to provide opportunities for teachers to reflect on practice. It is thus relevant to consider the outcomes of the research described in earlier chaptersⁱⁿ this context. The reports which teachers wrote about the interviews with children provided just such opportunities.

The implications for teaching formed a major part of both the discussions which followed the interviews with pupils and the reports which teachers wrote subsequently. All of the teachers included some discussion in their reports about the implications for teaching. Most of them indicated that the results had implications for all their teaching, not just food based topics. Many of them reported that they had found the activity of finding out what children understood particularly helpful and would use the strategy as a starting point for teaching about food in the future. One teacher, summarizing her interviews with children, wrote:-

"One-to-one discussion with children about their ideas, or carefully observing a child performing an investigation is particularly valuable as it has

implications for more meaningful learning." (FBC)

Another concluded:-

"The object of this study was to discover some of the ideas children might hold concerning food and diet. The implications of the resultant observations was ... more far reaching. ... How much more effective and enjoyable teaching is when children are encouraged to express their ideas ... and to feel accepted for their own opinions." (SJD)

Teachers sometimes pointed to the value of the activity in reminding them of the importance of using children's ideas as a starting point for teaching:

"As a vehicle for self analysis this project was certainly very effective. I have always felt that finding out "where the children are at" was crucially important, this has been a timely reminder of why."
(RMC)

Such reflective writing and analysis was common to all the reports which teachers wrote. Although each teacher's comments reflected their individual viewpoints, which were influenced by the different contexts in which they worked, including the type of school and the age of the children they taught, there were a number of issues which were raised by many people and which impinge on practice which is not limited to science, technology or health education. Some of the issues identified, such as observing and listening to pupils have important implications for assessment of the type identified in the TGAT Report (DES, 1988) and which underpinned the development of Standard

Assessment Tasks for Key Stage 1 of the National Curriculum from 1989 to 1991.

The major issues identified by teachers included:

1. **The importance of really listening to what pupils say:**

"It is important to listen to the children's answers even if they were not what you were expecting."

2. **The range of development even within the small sample of children interviewed from each class:**

"...the range of scientific development was greater than I anticipated."

" I was startled both by L's paucity of sorting skills and, by contrast, the level of refinement at which A operated."

A very significant outcome for many teachers was that children did not always perform according to expectation.

"I had expected K., a very articulate and confident boy who always performs well during problem solving activities to possibly be as good as C.. However without doubt C's ideas of food and diet far exceeded those of K and Ch."

3. **Observing one child is a means of developing the skills needed for observing larger groups in a class. Such skills will be of increasing importance in the context of assessment in the National Curriculum in England and Wales.**
4. **The need for continuity and progression in science is widely recognised (DES, 1985; DES 1989) however there**

were concerns amongst teachers that neither was being achieved; such concerns are widespread amongst science educators. If progression is to be achieved it is important to build on the knowledge that children already have in a planned way.

"While each teacher may cover the part of this topic (food) there needs to be more continuity and discussion on how the staff in school see a progression from reception to top junior."

5. The importance of discussion in learning, both discussion between pupils and between teacher and pupil, was acknowledged:

"Children need opportunities to discuss ideas and findings."

6. The choice of suitable activities, of a type identified by one person as meaningful activities. When teaching about food, particularly with younger children, it was important to:

"concentrate on ideas that they can experience, for example, grouping of foods."

7. The need for flexibility in implementing teaching plans to accommodate children's interests and to develop their thinking was commented on by some people:

"You must be prepared to alter your tack to pursue some of the children's ideas."

Comments such as those quoted above indicate that teachers were reflecting on their teaching. The author considers that the structured programme of discussions with

other teachers, interviews with children and written reports, which included reflection on the implications of their work for teaching, has proved valuable in helping participants to become more reflective practitioners. The research programme has enabled them to review and to extend their own knowledge, in an area where few have expertise and many lack confidence. It has also caused them to consider teaching strategies and learning outcomes in a more analytical way.

The ability to reflect upon practice which was encouraged by the research activities was a process which continued to develop during the course. The reports on teaching science related topics, which were written either in the term following the interviews with children or later in the course, provided further evidence that individuals were identifying and extending their understanding of this role. One teacher ended her report on teaching the topic of 'Food':-

"Being a reflective practitioner has opened the door to so many considerations ... the need for ample time... the importance of groupings of children and influencing factors, the importance of motivation and relevance... continuous on-going assessment, the importance of discussion... Just being aware of all these issues is a step in the right direction..." CBJ

The author suggests that it is only by becoming reflective practitioners of the type identified here that teachers will continue to develop professionally.

5.3 The teacher as researcher

"I expected to find the role of researcher more difficult ..."

This comment is indicative of the perceptions of many teachers about the esoteric nature of research which results in them concluding that research is difficult and that they therefore cannot undertake such studies themselves, or have little to contribute to educational research. One purpose of the study reported here was to enable participants to gain confidence in their ability to undertake research; the comment above indicates the positive outcome for one teacher.

Many teachers commented on the difficulties which they experienced in acting as a researcher, a role with which they were unfamiliar. Many wanted to extend the activity so that it became a "teaching situation". They found it difficult to stand back and not to make comments or provide 'answers'.

"I felt unsure as to what extent to intervene and I feel that I did not always ask enough questions."

Some saw themselves as testers rather than as researchers as is shown in the following comment:-

"I found it very difficult to transfer from being their class teacher to the role of tester because I know the children so well and associate with their feelings."

Prior to the interviews with children it had been suggested that the teachers make tape recordings and

transcripts of those parts of the discussion which they considered to be of particular significance. The use of a tape recorder during the interviews was found helpful in ways other than just revealing what was actually said by children.

" I have realised that if the responses given by the children were acceptable to my own ideas and understanding, then I did not question further."

Such responses have evident implications for all teachers.

Two teachers pointed out difficulties in learning what children think even in this type of interview where children are not expected to give "correct" answers. Some teachers identified the nonverbal clues that they were giving when talking with children, which they thought might have influenced the type of response which their pupils gave.

Most teachers appreciated how important is that ability to listen to what children actually say. This skill was being developed during the interviews and it has important implications for teaching, including assessment.

A significant outcome of the research was the increased sensitivity of all the teachers participating to the value of children's ideas and the ability to discern and to analyse those ideas when teaching larger groups. Background reading, in particular ideas from the Learning in Science Project (Osborne and Freyberg, 1985), was helpful in enabling teachers to appreciate the strength of children's ideas and the resistance of these to change through teaching.

Some teachers also recognized the wider implications of their study and the questions which it raised, which were well summarised by one teacher:

"More questions were raised than answers and I found it difficult to suppress the urge to press on and ask those questions, questions which would concern:

1. Home background/income/normal meal time patterns.
2. Peer/sibling family issues.
3. Food fashions.
4. Home or family or environmental expectations." (RMC)

Interestingly the school in which this teacher worked had already undertaken a dietary survey of children in the school and concluded that many children's diets were low in some essential nutrients, most notably vitamins.

Through their active participation in this project, teachers gained an insight into the nature of educational research. It is possible that this work, including the opportunity which it provided for participants to reflect on their practice in the classroom, may help them to identify and to recognise the implications of research findings for their own teaching practice in the future. A more tangible outcome has been the number of teachers who have become interested in research and who have gone on to undertake further study at the Institute.

5.4 Planning and implementing teaching

There were a number of ways in which teachers incorporated the findings from the research into teaching carried out later in the course. The reports on the interviews sometimes included details of how participants had extended the task or planned to utilise the findings from the interviews in subsequent work on food; in 1991 further information came from the post-interview questionnaire. Evidence came also from reports on teaching science focussed topics later in the course. A third source of information about the impact of the programme came from school policies for science which teachers developed during the course. These policy documents generally included examples of topic webs, of the type shown in Figure 31, or examples of material compiled during the course, for example Appendix XIII, to assist other members of staff in planning for teaching. The policy documents often included reference to technology and health education which provided opportunities for reference to teaching about food.

5.4.1 Extending the interviews into classroom teaching

Teachers frequently reported on how they could extend the activities as part of teaching about food; an example of such plans is shown in Appendix XII. The post-course questionnaires in 1991 provided further information about how individuals would incorporate their findings into their schemes of work. All stressed the importance of starting

with children's ideas and building on and developing their experience of food. Mention was made of the need to emphasize the positive aspects of eating; everyone stressed the problems which children had in understanding concepts related to nutrients.

On occasions the reports discussed how the interviews had been extended into classroom teaching. One person asked the children in his class to bring in pictures of food, from newspapers and magazines, prior to interviewing.

"I wanted them to appreciate the rich diversity in the foods that we eat The proposal (to bring in pictures) gave rise to a critical discussion about the nature of food and what counts as food:

'Can we bring in a picture of a Mars bar, Sir?'

'He can't sir because that's a sweet, isn't it?'

'But we eat it sir, so it must be a food' ..."

This initial discussion revealed much about the understandings and misunderstandings in the class. The following day members of the class brought in not just pictures but examples of different food, including sugar cane, which became the starting point for more detailed work than he had initially planned.

There was one occasion when an eight year old (S.) extended an activity spontaneously during an interview. On being invited to select meals she immediately went to the sticky paper drawer, selected two sheets of paper, one of which she gave her teacher, with the comment:

"Pretend it's round."

She herself retained the second piece of paper, which

represented a plate although it was not plate shaped. The activity of choosing meals using the cards developed into a game in which the teacher was invited to participate. S. selected foods for different courses of each meal, both the teacher and S. had to pretend to eat the food and "make do with dirty plates." S. was involved in the activity and very much in control, the situation provided evidence of both her social skills and understanding about food and why we eat it:

"It's food and we eat it at meal times."

Later that same day S. collected the pictures of food from the teacher's table and with three other children, one of whom had also been interviewed, started "cooking" meals for the group in the weather station which formed the focus of the science topic that term. The group chopped food, then cooked it using a box on which they painted red rings for heating the food. The activity included collaborative problem solving as well as role-play. Their conversation revealed much about their understanding about food:

S. "Oh no, the snow it's too deep and they'll die without food."

J. "If I go on skis and tie a rope we can send food."

(miming filling a basket)

S. " Bread (is) a good food and (in?) cold."

This teacher was aware of the advice given by Osborne (Osborne and Freyberg, 1985) to provide children with opportunities to try out ideas by investigating themselves.

5.4.2 Teaching about food

Appendix XIII illustrates some of the ideas for teaching about food which were generated in course workshops in the period following the interviews with children. Ideas such as these were often used as a basis for planning for teaching, as were those identified by teachers in the pre-interview questionnaire. The summaries of the ideas generated in the questionnaire form Appendix X.

The reports written in the term following the interviews with children indicated that the teachers experimented with new strategies and ways of monitoring progress. Only a small proportion taught a food related topic in the term following the interviews. However, much of what had been learnt, particularly in relation to observing children and elucidating ideas that children already have as a starting point for teaching, was incorporated into the teaching of all science based topics. Those teachers who did teach 'Food' as a topic utilized what they already knew about the range of understandings which their pupils had about food and diet as a starting point in their planning.

The reports by those who taught food related topics provide insights into the way in which their approaches to the topic broadened, partly as a result of having been asked to focus on an aspect not attempted before. The strategies used are well illustrated by the two teachers who, in 1989/90, started by finding out what their pupils already knew; they provided opportunities for pupils to ask

questions about food and used these questions as starting points for developing work in all areas of the curriculum.

The initial class discussions resulted in pupils listing the things they wanted to know about food. This list was then used to plan further work and investigations to find the answers to the questions raised, such as:-

"Is your nose important in tasting food?"

"Does touching with your tongue identify food?"

"Do we eat different kinds of food today, than our grandparents did when they were our age?"

"Why do we need food?"

"What kind of food should we eat most/least of?"

"What happens to the food we eat?"

"What do different people eat in different parts of the world and why?"

Some of these questions resulted in scientific investigations, others in library research and discussions related to health education. The teachers encouraged pupils to take responsibility for their own learning by drawing up plans for work in discussion with the class. Pupils' ideas about food and diet were challenged during group and class discussions. In one instance a class compared food choices made at the start of the topic with "healthy menus" compiled after discussions about food choices - the most significant difference was the inclusion of wholemeal bread and more fruit and vegetables rather than the exclusion of all sweet foods and crisps. In concluding the topic one teacher provided an opportunity for reflective writing by asking pupils to write down what they now knew about food. Such

writing provides opportunities for children to reflect and to identify further questions that they want to ask; it also helps teachers to judge learning outcomes.

The type of topic work described above accords with the models for science and nutrition education outlined by the National Curriculum Council in their curriculum guidelines (NCC, 1989; 1990) which promotes active learning and involvement by pupils.

5.5 Issues of assessment

Ways of monitoring children's progress allied to assessment as part of the National Curriculum were issues of concern to all the teachers working at the Institute of Education between 1989 and 1991. In the experience of the author assessment is viewed as problematic by teachers who are still gaining confidence about teaching science.

Teacher assessment of pupils was not the primary focus of the research but issues of assessment were raised by many teachers when considering the implications of their findings, as is evident in the points raised by teachers in Section 5.2.

The majority of the teachers involved considered that the activities in which they had engaged had enabled them to:

1. evaluate the learning experiences they provided for children,
2. diagnose strengths and weaknesses of individual pupils,

3. modify teaching to match pupils' learning.

All of the points noted above are prerequisites for successful diagnostic assessment and for developing programmes of work best suited to the needs of individual pupils.

The strategy of interviewing individual pupils has proved an effective method of helping teachers to appreciate the range of understandings held by pupils in a class. Such appreciation is of fundamental importance in monitoring the progress of pupils in ways consistent with those outlined in the National Curriculum proposals (DES, 1989) and the report by the Task Group on Assessment and Testing (DES, 1988). Observing pupils in a one-to-one situation also enabled teachers to identify the contribution of individuals to group activities, as was apparent from their own reports and from workshops in which they were involved later in the course, which provided opportunities for observation and analysis of group activities.

Tape recording interviews was particularly useful in assisting teachers to analyse their interactions with children. One teacher wrote:

"... we must not be the one with all the answers so that the child is more occupied with what the teacher wants to hear that what the child really notices. I felt T.'s manner in answering my questions so 'properly' indicated this. Some of my comments, such as "Right, now, O.K." could easily make children think that it is time to be moving on. ... we must be positive towards the children's work and their line of

enquiry, be it different from ours." (ND) (teacher's underlining)

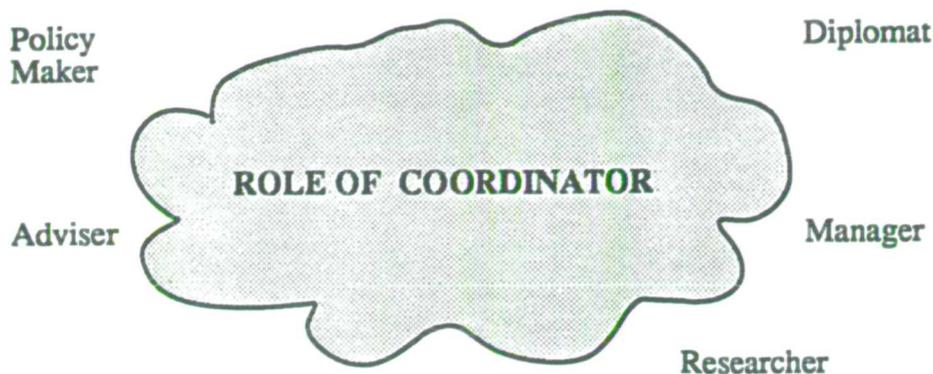
Tape recording discussions in the classroom on a regular basis is not practical, nor indeed advisable, but it is evident that it is a strategy which has a part to play in helping primary teachers in assessing pupils attainment of skills and knowledge and understanding.

5.6 The role of the science coordinator as agent of change

Research by Hebden et al (1977), which investigated curriculum change strategies in one Local Education Authority linked to a Schools Council Curriculum Development Project in geography, suggests that as teachers become more involved in curriculum development in their own classrooms they tend to become more involved with change in the school system. Such teachers are therefore in a position both to stimulate change and to increase the rate at which change occurs in their schools; they become therefore agents of change.

The majority of teachers involved in the research programme described in the last two chapters have responsibility for science in their schools and are thus in a position to act as agents of change. Innovative practice encouraged during their studies can lead to change which is not limited to their own classrooms. Reports by co-ordinators during their Institute courses indicated that they did stimulate change in their schools and, on occasions, increased the pace of change.

Figure 41 The Role of the Science Co-ordinator - I
 January 1991, Institute of Education, 20 Day Course



RESPONSIBILITIES

TASKS

* STAFF SUPPORT

(overseeing implementation of N.C)

- Planning
- Assessment
- Record keeping
- Good Practice

* RESOURCE MANAGEMENT

- Organising
- Ordering
- Finding

* SCIENCE DOCUMENTS

- Co-ordinating staff on policy and schemes of work
- N.B. special needs and multicultural aspects equal opportunities
- reviewing present documents

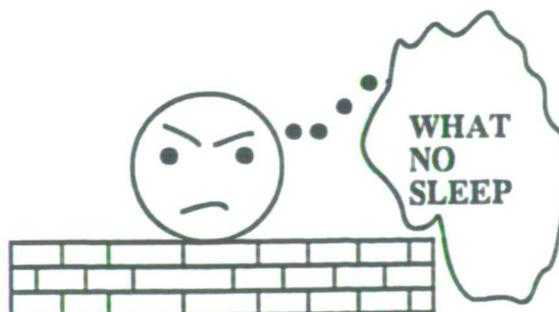
* LIAISON

- 1st Schools
- Secondary
- Parents
- Governors
- Industry links

- Continuity schemes
- Meetings
- N.C. evenings
- Reports to governors

* UPDATING

- personal research
- attending courses
- organising INSET



RESPONSIBILITIES

ASSOCIATED TASKS

Establishing Aims and Objectives for Science

Resources

- order
- organise
- making colleagues aware of what is available
- 'checking' resources

Support for Staff

- give advice on topics
- building confidence e.g. use resources
- making staff aware science going on in school
- analysing NC/ASI
- assessment e.g. KSI

Keeping up to date

- reading relevant magazines
- personal development through courses, visits to other schools/boroughs
- aspects of safety

Science Policies

- development
- implementing
- monitoring
- re-evaluating
- continuity
- progression
- integration with other curriculum areas

Record Keeping

- 'standard' for school?
- tie in with national curriculum
- manageable
- purpose

INSET

- colleagues - 1-2/year
focus varies
- cluster group
- specific areas e.g. science
- general areas e.g. assessment- science focus

Liaison - Staff

- co-ordinators - cluster group
- science adviser
- confer with head
- parents
- other curriculum coordinators
- interface e.g. primary/secondary

Providing Opportunities for Science

- look at school environment, can you build a pond/garden etc.
- set up nature trails etc.
- provide examples of good classroom practice

Project

- developing e.g. whole school project - single theme

Open Days (ILEA days)

- cluster groups
- discussion/workshop
- parents

The role of the co-ordinator in schools is summarized in Figures 41 and 42; these summaries were developed as a result of discussion with a group of Co-ordinators at the Institute of Education in 1991. The figures illustrate the range of responsibilities which Co-ordinators have, responsibilities which go far beyond teaching in their own classrooms. Co-ordinators support other staff in their classrooms, run school based in-service programmes, which frequently include practical workshops, and have responsibilities for the development and implementation of policy. Responsibilities such as these require teachers to have management skills. In small schools in particular teachers may have responsibility for more than one area of the curriculum; science co-ordinators frequently have responsibility for technology or health education in addition to science. Co-ordinators are viewed by colleagues as having expertise in assessment of science. In order to cope with the demands of coordination teachers must feel confident about teaching science and of their own knowledge about scientific concepts. One purpose of the course at the Institute of Education, including the research programme, was to help to develop the skills needed to carry out the role of co-ordinator.

One of the outcomes of working together and sharing ideas as part of the course programme was the emergence of support networks which continued after courses had finished. In many cases support came from advisory teachers in individual London boroughs (some of whom were former participants on courses for Co-ordinators in primary science

at the Institute of Education). However, in other instances individuals working in different boroughs continued to meet and work together. The networks have included ongoing links with the Science Education Department at the Institute of Education and involvement of individuals in further school based research. Such networks provide an important basis for continuing professional development.

Although provision for in-service programmes in schools is now more widespread there remains a need for continued professional development, not just for co-ordinators but for all teachers, which takes place outside schools.

Opportunities to engage in educational research can provide an important way of ensuring that teachers are provided with a means for professional development. It is to be hoped that devolved funding to schools will not preclude opportunities for INSET linked to research.

5.7 Curriculum development in science, technology and health education

In considering the implications of the findings for curriculum development in science, technology and health education it is important to recognize the context in which this study took place. When the study began the National Curriculum was still in an embryonic state; the Working Party for science had not produced its initial report and there was much uncertainty about what would be involved in teaching science in primary schools. In 1991 science as a core subject has become a reality in the primary curriculum,

assessment of science at Key stage 1 is still being evaluated. The statutory order for Technology in the National Curriculum were only published in 1990. Guidance on health education as part of the National Curriculum was provided at the end of 1990. The National Curriculum is still being implemented in primary schools and the outcomes have still to be evaluated.

As discussed in chapter I (Section 1.3.4), food as a topic features as a part of the national curriculum in science, technology and health education, as well as other areas of the curriculum such as geography. Although the National Curriculum specifies areas of knowledge and understanding and skills which should be developed, it is the responsibility of schools and teachers to develop their own programmes of study (DES, 1988, NCC, 1989). Innovative approaches to the curriculum are not debarred by the National Curriculum, although it could be argued that they are constrained. Furthermore, teachers are able to develop their own approaches to particular topics. It is therefore appropriate to consider the implications of the research findings for the curriculum and for teaching strategies which are conducive to good practice.

The teachers involved in the study perceived the value of eliciting children's ideas prior to initiating work in science and health related topics in primary schools. They also identified the importance of using the insights gained as a basis for planning more appropriate learning activities in these areas of the curriculum. The strategies for learning include challenging children's ideas in ways

similar to those suggested by Cosgrove and Osborne (Cosgrove and Osborne, 1985) and Driver (Driver et al, 1987).

Teachers were expected to develop policies for science, although not for health education, as part of their courses at the Institute of Education and they frequently incorporated ideas from the research into these policies and made reference to cross-curricular areas such as health education. Specific findings from the research were also incorporated into workshops run by teachers, as discussed above (Section 5.6). Workshops of this type have the potential to lead to school based curriculum development.

5.8 Developing policies for nutrition education

Nutrition education, as was discussed in Chapter I, has been identified by the NCC as part of Health Education (NCC, 1990b), which itself forms one of five cross-curricular themes in the National Curriculum for England and Wales. The NCC recognizes the importance of planned programmes for health education:

"Health education cannot be left to chance. ... A coherent health education programme is required if pupils are to be encouraged to establish healthy patterns of behaviour, to acquire the ability to make healthy choices and to contribute to the development of a healthy population." (NCC, 1990b)

The support for health education as part of the curriculum and the recognition of the importance of planned programmes for health education is particularly welcome.

The unequivocal statements by the NCC on the responsibilities which schools have to provide all pupils with accurate information about health matters and the promotion of behaviour conducive to health are a further indication of recognition of the importance of health education for all pupils. The NCC emphasizes the importance of health education as part of the formal curriculum and of schools identifying where health education is located in that curriculum. Health education is viewed as something which "permeates the ethos of the school" (NCC, 1990b). The notion of progression and continuity, which first found expression in the 'Science 5-16: a statement of policy' (DES, 1985), is reiterated and endorsed. In specifying the content of school policies for health education nine components are identified, of which nutrition is one.

"Education about nutrition covers the relationships between diet and health, the nutritional quality of different foods and food safety. It encourages pupils to make healthy choices." (NCC, 1990b, page 5)

The NCC emphasizes that schools must recognize and be sympathetic to the needs of all their pupils. It suggests that the formulation of policy should involve parents, teachers and governors. The idea of parent and community involvement is important and is consistent with suggestions by the HEA (HEA, 1990) of the health promoting school in which parents and community form one of three elements, the others being the health education curriculum and the ethos of the school.

The starting point for the development of policy

should, in the author's opinion, be the identification of children's ideas and eating patterns, a view endorsed by the NCC (1990b). The findings from the research discussed in Chapter IV have relevance for planning and developing policy. Children in primary schools already have ideas about which foods are healthy and unhealthy. Some of the ideas which they hold indicate confusions which need to be addressed in policies for nutrition education. The evidence of the ways in which children group foods and the types of choices which they make forms a useful basis on which to develop teaching about food and health. The findings confirm those of earlier work with secondary pupils in London (Newsome, 1983) that methods of grouping foods commonly used in teaching, particularly nutrient groupings, are not being used by pupils, nor are they understood. The evidence from the author's work indicates that children of five to twelve years have little understanding of nutrients, even where teachers have introduced nutrient terminology and groupings. A further factor which should be considered is the evidence that many primary teachers are themselves uncertain about nutrient terms and the function of nutrients in the body. For these reasons the author suggests that policies for teaching should focus on foods rather than nutrients and that food grouping systems, where they are deemed to be necessary, should take account of and build on systems which children already use. The categories suggested by for example, the Healthy Eating Campaign (1991), provide a useful starting point, namely:

* fruit, salads and vegetables,

- * bread, potatoes and cereals,

- * meat, fish and dairy foods.

The categories provide a useful basis for planning and preparing meals and snacks consistent with current WHO (1990) and national guidelines (DoH, 1991). Such categories provide a sensible basis for subsequent study of nutrients.

In some respects the suggestions above appear to conflict with some of those suggested by the NCC (1990b), particularly their guidelines for health education for Key stage 2 which include statements that children should:

- * know that a diet is a combination of foods, each with a different nutrient content;
- * know that different nutrients have different effects on the body, and the amount in the diet, and balance between them, can influence health, e.g. sugar and dental health;

The way in which such statements are translated into practice will be very important. In the light of this research the apparent emphasis on nutrients does not appear to be helpful for teachers in primary schools. Guidance is needed to ensure that approaches which start with food groupings are used as a basis for teaching at key stage 2.

One of the findings from the interviews was the prevalence of negative attitudes to certain foods or food constituents, such as fats. There are indications that these attitudes are linked to confusion about what is meant by 'healthy', or 'unhealthy', foods. In order to address these issues it is important, in the author's view, that policies should stress the positive aspects of eating food,

including enjoyment, and place emphasis on foods that should be eaten rather than foods which should not be eaten. Such an emphasis is consistent with recent publications from both the World Health Organisation (WHO, 1990) and the United Kingdom government (DoH, 1991) which promote positive guidance of this type.

The findings from the interviews support the statements by the NCC (1990b) that policies for nutrition education should not merely provide guidance about teaching factual knowledge about food and health. Policies need to recognize that the importance of food goes beyond that of satisfying hunger. Teaching about food and health should encompass the different elements of food culture, which include the cultural, emotional, and ethical considerations which affect food choice as well as economic and political influences. These factors are summarised in Figure 2. Food is also an intrinsic part of world religions and its importance must be recognized in developing policy, particularly in the context of the school as part of a pluralist society. Comments by girls, in particular, during the interviews show how many children are very aware of their self image; this is reflected in the foods they eat and their ideas concerning health and diet.

Policies for nutrition education should be seen in the context of whole school provision, including that for school meals. The links between school meals provision and education identified in the Education Act of 1944 need to be restored. One way of achieving this goal is through those responsible for school meals provision, including caterers

and meals supervisors, governors and teachers, parents and children working more closely together in planning and implementing guidelines for school meals as part of the curriculum. The Working Party convened by the Coronary Prevention Group (CPG) and the Assistant Masters and Mistresses Association (CPG, 1987), pointed out that school meals should reinforce classroom teaching about diet and health. Ways in which links could be made between school meals and the primary curriculum were the subject of a workshop organised under the auspices of the World Food Programme and Unesco in 1983 (Guruge, 1985); the recommendations from this meeting stress the importance of school meals as part of the educational process in schools. Specific ideas for teaching food based topics which make links between different areas of the primary curriculum, including science and technology, and school meals are not new (Turner and Frost, 1986; Turner et al, 1989); the 'topic webs' shown in Figures 26 and 31 provide illustrations of how such links could be made. Suggestions for ways in which food could be taught as a cross curricular topic or theme were sometimes recorded by teachers as part of the reports on their interviews; Appendix XII provides an example based on 'Feeding the Family'.

The subject of what children eat in schools at times other than school meals, for example during break-times, is an important element of nutrition education which has been neglected in the past and which should form part of school policies. Many primary schools already have policies about foods which may be consumed in school, for example

permitting fruit and banning sweets. Rarely are such policies linked to classroom teaching in a planned and coherent way. Suggestions for ways in which such links could be made come from practice in one school which was reported by Turner (1986). In this school parents and teachers decided that instead of parents buying snacks for children, which often included foods like crisps, they would contribute a small amount towards a snack which would be provided in school. The intention was that groups of children in a class would take it in turns to be responsible for choosing, buying and preparing a snack item, for example carrot sticks or a flan which they had cooked. The preparation of the snack was linked to work in a number of areas of the curriculum, for example, children collecting money, buying food from the local market and serving portions, were developing mathematical skills and knowledge. Aspects of nutrition education, for example the promotion of healthy eating patterns, were an intrinsic element of the programme.

One of the potential strengths of nutrition education policies is that they permit connections to be made between different areas of the curriculum and to involve the use of the whole school environment. The devolved budgets for schools which are a major outcome of the Education Reform Act (1988) mean that schools have greater autonomy in the use of school grounds. Such autonomy provides the possibility for growing plants in ways perhaps not possible in the past. Some schools already possess school gardens, a few even have greenhouses, and these can be used for growing

food plants which can extend and develop children's understanding of scientific and health concepts, as well as leading to consideration of why certain plants are grown and used for food in different parts of the world. Ideas for using school grounds have been provided by the Learning through Landscapes Trust (Young, 1990) who also indicate how links can be made to the National Curriculum (Booth, 1990). Suggestions for extending the range and types of food plants grown in ways consistent with good practice in schools as part of a multicultural society come from work by Cade (1988) and joint initiatives by the Association for Science Education and Nature Conservancy Council (ASE/NCC, 1990).

Evidence from primary teachers on courses at the Institute of Education indicates that writing school policies is only a first step in implementation. It is easy for policies to be written and then to gather dust in the staff room. Successful policy implementation depends on a number of factors. An essential factor is that all staff perceive the importance and relevance of the policy for themselves and for the children they teach. This perception is heightened if individual teachers are involved closely in both the writing of the policy and in making decisions about how it will be implemented. The designation of a member of staff who will have overall responsibility for developing and coordinating the implementation of the policy is essential. In turn successful coordination depends on support from headteachers, including time for discussions with other staff and for monitoring the implementation of the policy. The guidance given to schools by the NCC

(1990a) on the development of health education as part of the cross curricular themes in the National Curriculum should, in theory, provide the impetus for all schools to develop the necessary policies.

5.9 Summary

The implications of the research findings for teachers and schools and for the development of policy for nutrition education have been discussed in some detail in this chapter. Attention has been drawn to the positive outcomes of the research for teachers, particularly in the opportunities which it afforded for reflection on practice and professional development. The discussion has considered the implications of the findings for planning for teaching food based topics and in developing policies for nutrition education in schools. Areas where children require more experience have been identified and emphasis placed on the importance of providing children with opportunities and time to explore ideas.

The findings support the author's view that policies for nutrition education should focus on foods which children eat rather than on nutrients and nutrient groupings. Such policies should recognize the values which children have about food and seek to redress negative attitudes. The sample interviewed was small but if the findings about children's ideas and attitudes to food are indicative of ideas which are widespread amongst children generally, then the issues are ones which should be addressed by educators and policy makers alike.

CHAPTER VI

CONCLUSION

Four questions were posed at the beginning of this thesis:

1. What are the ideas which children of primary school age hold about food?
2. On what basis do children make food choices?
3. What strategies can teachers use to find out more about children's ideas?
4. How can the findings about children's ideas be used to further both the professional development of teachers and curriculum development in nutrition education?

The outcomes of the research indicate that more has been learnt about the ideas which children hold about the food they eat and why they eat the food they do. The ideas about food and diet held by children of any particular age are diverse, but patterns are discernable in which it is possible to trace the influence of home background, peer group pressures and prior teaching. These findings accord with results from earlier research with older pupils, including that by Newsome (1983) in her work with adolescents in London. For young children, as might be expected, the home is the most important influence in determining food choice.

Children's knowledge of nutrients is in general confined to those substances with which they are familiar

from their daily lives. From the explanations which children give it is evident that their understanding of the function of such substances in the body is far less extensive than teachers anticipated, even where teaching about nutrients had taken place. Furthermore, many of the understandings which children possess are at variance with those held by nutritionists. The comments which children made indicated confusion about both the function and characteristics of nutrients.

Further research is required to determine whether the patterns identified from the small sample of children interviewed in this study are representative of ideas held by children in London schools, or of other parts of the United Kingdom. In particular more detailed investigation is needed about the reasons for children's food choices.

The purposes outlined in Chapter III in relation to the professional development of teachers have been achieved. The strategy of working with individual or small groups of children in the way outlined is an effective one; teachers have been helped to gain greater understanding of the ideas that children hold about food and diet; teaching strategies are being developed which build upon the knowledge that children already have. The research is, however, only an initial step in the further professional development of primary teachers in science and health education. Long term monitoring is required to gauge the success, or otherwise, of the methods discussed. Such monitoring should consider pupils' progress in relation to their understanding of food and diet, including food choices and health. It should also

examine the extent to which the curriculum initiatives developed during the study become a part of the normal teaching strategies employed by teachers.

BIBLIOGRAPHY

- Abelson, P.H., (1975) Food: Politics, Economics, Nutrition and Research Washington: American Association for the Advancement of Science
- Abrams, M., (1946) The Condition of the British People 1911-1945 London: Victor Gollanz
- Achterberg, C., (1988) 'A Perspective on Nutrition Education Research and Practice' Journal of Nutrition Education Vol.20, No.5, pp.240-243
- Achterberg, C. and Trenkner, L.L., (1990) 'Developing a Working Philosophy of Nutrition Education' Journal of Nutrition Education Vol.22, No.4, pp.189-193
- Adamec, C., (1972) 'Survey of Nutrition Knowledge as a part of Nutrition Education' Journal of Nutrition Education No. 3 Summer 1972 pp. 108-111
- Agricultural Research Council/ Medical Research Council (1974) Food and Nutrition Research London: H.M.S.O.
- Aldrich, R., (1982) An Introduction to the History of Education Studies in Teaching and Learning, London: Hodder and Stoughton
- Aldrich, R., (1988) 'The National Curriculum: an historical perspective' in Lawton, D. and Chitty, C. (eds.) The National Curriculum Bedford Way Series 33 London: Kogan Page
- Amcoff, S. (1977) The Impact of Mal- and Undernutrition on the Learning Situation 1965-1976 Selected Annotated Bibliography Paris: Unesco
- Anderson, D. (ed.) Health Education in Practice London: Croom Helm
- Anliker, J.A., Laus, M.J., Samonds, K.W. and Beal, V.A., (1990) 'Parental Messages and the Nutrition Awareness of Preschool Children' Journal of Nutrition Education Vol.22, No.1 pp.24-29
- Appleby, A.B., (1978) 'Disease, diet and history' Journal of Interdisciplinary History, Vol.8, pp.725-735
- Appleton, K. 'A learning model for science education' Research in Science Education Vol.19, pp.13-24
- Arnold, B. (1982) 'Pre-requisites for learning some difficult concepts in Biology' Aberdeen College of Education

- Asian Programme of Educational Innovation for Development (1980) Towards Better Health and Nutrition Bangkok: Unesco
- Asoko, H., Leach, J. and Scott, P. (1991) Sound and Music Shropshire - CLIS Joint Project: An interim report. University of Leeds: Children's Learning in Science Project
- Assessment of Performance Unit (1981) Science in Schools: Age 11 Report No.1 Summary Report No.1, London: Department of Education and Science
- Assessment of Performance Unit (1981) Report on Science at age 11 H.M.S.O: London
- Assessment of Performance Unit (1983) Science at age 11 Science Report for teachers: 1 London: D.E.S.
- Assessment of Performance Unit (1985) Practical Testing at ages 11, 13 and 15 Science Report for teachers: 6 London: D.E.S.
- Assessment of Performance Unit (1986) Planning Scientific investigations at Age 11 Science Report for teachers (author Harlen, W.) London: D.E.S.
- Assessment of Performance Unit (1989a) National Assessment: The APU Science Approach London: H.M.S.O.
- Assessment of Performance Unit (1989b) Science at Age 11: A Review of APU Survey Findings 1980 - 1984, London: H.M.S.O
- Association for Science Education (1966) Science for Primary Schools 1. Children Learning through Science. London: John Murray
- Association for Science Education (1971) Science for the Under-Thirteens Hatfield: Association for Science Education
- Association for Science Education (1976) A Post of Responsibility in Science Science and Primary Education Papers No.3 Hatfield: Association for Science Education (also revised edition 1981)
- Association for Science Education (1979) Alternatives for Science Education A Consultative Document Hatfield: Association for Science Education
- Association for Science Education (1981) Education through Science Policy Statement Hatfield: Association for Science Education

- Association for Science Education and the Nature Conservancy Council, (1990) Opening Doors for Science: Some aspects of environmental education and science in the National Curriculum for 5 to 16 Hatfield: Association for Science Education
- Attar, D.(1990) Wasting Girls' Time:The History and Politics of Home Economics London: Virago Press
- Atwater, W.O.,(1894) 'Investigations on the Chemistry and Economy of Food' U.S. Department of Agriculture Bulletin No. 21, p. 211
- Ausubel, D.P. (1963) The Psychology of Meaningful Verbal Learning New York and London: Grune and Stratton
- Ausubel, D. (1968) Educational Psychology New York: Holt, Rinehart and Wilson
- Ausubel, D.P. and Robinson, F.G. (1971) School Learning: An introduction to Educational Psychology London: Holt Rinehart and Winston
- Ausubel, D.P., Sullivan, E.V. and Ives, S.W. (1980) Theory and problems of child development New York and London: Grune and Stratton (3rd.edition)
- Axelson, M.L., Kurini, N. and Brinberg, D. (1986) ' An Analysis of the Four Food Groups Using Multidimensional Scaling' Journal of Nutrition Education Vol.16, No.6, pp.265-273
- Aylward, F., (1972) Food and Nutrition Education and Training with particular reference to General Education Systems in Developing Countries Paris: Unesco
- Bacharach, A.L. (1947) Science and Nutrition London: Watts (third edition)
- Baker, M.J. (1972) 'Influence of nutrition education on fourth and fifth graders' Journal of Nutrition Education Vol.4 pp.55-58
- Balding, J., (1977) Just one minute London: Health Education Council
- Bandurski, M.S. (1981) 'Secondary nutrition education: assessment, curriculum and administration' Thesis Ed.S Central Michigan University
- Barclay, E.J. and van der Vynckt, S. (eds) (1984) Easy to make teaching aids for nutrition teaching-learning Nutrition Education Series, Issue 10 Paris: Unesco

- Barker, J.C., McKenzie and Yudkin, J. (eds.) (1966) Our Changing Fare: Two Hundred Years of British Food Habits London: Macgibbon and Kee
- Barker, J.C., Oddy, D.J. and Yudkin, J., (1970) The dietary surveys of Dr Edward Smith, 1862-3 London: Staples
- Barker, M. (1985) 'Teaching and Learning about Photosynthesis' Science Education Research Unit, University of Waikato, Working Papers Nos.220-229
- Barker, M.A.B. (1986) 'The description and Modification of Children's view of Plant Nutrition' New Zealand: University of Waikato
- Barker, M. and Carr, M., (1989a) 'Teaching and learning about photosynthesis Part 1: An assessment in terms of students' prior knowledge' International Journal of Science Education Vol.11 No. 1: pp. 49-56
- Barker, M. and Carr, M., (1989b) 'Teaching and learning about photosynthesis. Part 2: A generative learning strategy' International Journal of Science Education Vol.11, No.2, pp. 141-152
- Barker, M. and Carr, M., (1989c) 'Photosynthesis - can our pupils see the wood for the trees?' Journal of Biological Education Vol. 23, No.1, pp. 41-44
- Barnes, D., Britton, J., Rosen, H. and L.A.T.E.(1969) Language, the learner and the school Penguin Papers in Education, Harmondsworth: Penguin
- Barnes, D. (1976) From Communication to Curriculum London: Penguin Books
- Bartels, F.R., (1977) Some Conclusions, Observations and Suggestions relating to the report of the survey on the position of nutrition within educational systems Paris: Unesco
- Bassett, G.W. (1971) 'Modern developments in Primary Education in England' in Hooper, R. (ed.) The Curriculum: Context, Design and Development Edinburgh: Oliver and Boyd pp.465-482
- Basu, T.K. and Schorah, C.J., (1982) Vitamin C in Health and Disease London: Croom Helm
- Beaton, I.(1891) Cookery Book London: Ward Lock, Bowden
- Beatty, W.K., (1977) 'The history of nutrition: a tour of the literature' Fed. Proceedings, Vol.36, pp.2511-3

- Beeukes, A.M. (ed.) (1967) Essays on the History of Nutrition and Dietetics; reprinted on the occasion of the 50th anniversary of the founding, in 1917, of the American Dietetic Association. Chicago: American Dietetic Association
- Bell, B.F. (1981a) 'When is an animal not an animal?' Journal of Biological Education Vol.15 No.3 pp 213-218
- Bell, B.F. (1981b) 'What is a plant? - Some children's ideas' New Zealand Science Teacher Vol.31, pp. 10-14
- Bell, B., (1985a) 'Students' ideas about plant nutrition: What are they?' Journal of Biological Education Vol.19, No.3 pp.213-218
- Bell, B (1985b) 'Students' Understanding of Plant Nutrition' in Bell,B.,Watts, M., Ellington, K.(eds.) Learning, Doing and Understanding in Science: Proceedings of a Conference. 11-13 July 1984, Woolley Hall, Nr. Wakefield. SSCR, London: 36-39
- Bell, B.F. and Barker, M. (1982) 'Towards a scientific concept of 'animal' Journal of Biological Education Vol.16 No.3 pp.197-200
- Bell, B., Barron, J. and Stephenson, E. (1985) 'The construction of meaning and conceptual change in classroom settings.' Case studies on plant nutrition. Centre for Studies in Science and Mathematics Education, University of Leeds
- Bell, B.F. and Brook, A. (1984) Aspects of Secondary Students' understanding of Plant Nutrition: Full Report, Children's Learning in Science Project, University of Leeds: Centre for Studies in Science and Mathematics Education, University of Leeds.
- Bennett, N.S.and Jordan, J., (1975) 'A typology of teaching styles in primary schools', British Journal of Educational Psychology, Vol. 45, pp. 20-28
- Bennett, N., (1976) Teaching Styles and Pupil Progress London: Open Books
- Bennett, N., (1988) 'The Effective Primary School Teacher: the Search for a Theory of Pedagogy' Teacher Education Vol.4 No.1, pp 19-30
- Bentley, D. (1987) Better Science: Health and science education Curriculum Guide 9 London: Heinemann/Association for Science Education for SCDC
- Beougner, J.E., (1979) 'The cognitive effects of a health education program on nutrition for selected primary grades' Ph.D. thesis, Ohio State University
- Berger, N., (1990) The School Meals Service London: Northcote House

- Bernstein, B. (1971) Class, Codes and Control: Vol.1
Theoretical Studies towards a Sociology of Language.
London: Routledge and Kegan Paul
- Bernstein, B. (1973) Class, Codes and Control: Vol.2
Applied Studies towards a Sociology of Language
London: Routledge and Kegan Paul
- Bernstein, B. (1975, revised edition 1977) Class, Codes and Control: Vol.1 Towards a Theory of Educational
Transmission London: Routledge and Kegan Paul
- Beveridge, Lord, (1949), 'The London School of Economics'
in Cole, M. (ed.) The Webbs and their work
London: Frederick Muller
- Bewley, B.R., Bland, J.M., and Harris, R., (1975) 'Factors
associated with the starting of cigarette smoking by
primary school children' British Journal of
Preventative and Social Medicine Vol.27, No.3,
pp.152-153
- Blenkin, G.M. and Kelly, A.V. (1983) The Primary Curriculum
in Action: A Process Approach to Educational Practice
London: Harper and Row
- Bloom, J.W. (1990) 'Contexts of meaning: young children's
understanding of biological phenomena' International
Journal of Science Education Vol.12, No.5, pp.549-561
- Birch, L.L, Zimmerman, S.I. and Hind, H. (1980) 'The
influence of the Social-Affective Context on the
Formation of Children's Food Preferences' Journal of
Nutrition Education Vol.13 No.1 S.pp.115-118
- Board of Education (1902) Code of Regulations for Day
Schools
- Board of Education (1903) Report for the Year 1902-1903,
Cd. 1763, London: H.M.S.O.
- Board of Education (1904) Report for the Year 1903-1904,
London: H.M.S.O.
- Board of Education (1910) Report for the Year 1909-1910,
Cd. 5616, London: H.M.S.O.
- Board of Education (1911) Report for the Year 1910-1911,
Cd. 6116, London: H.M.S.O.
- Board of Education (1912) Report for the Year 1911-1912,
Cd. 6707, London: H.M.S.O.
- Board of Education (1914) Report for the Year 1913-1914,
Cd. 7934, London: H.M.S.O.
- Board of Education (1914) Memorandum on the Teaching of
Science to Boys in Certain Public Elementary Schools
in London 14.5.1914 London: P.R.O.

- Board of Education (1926), The Education of the Adolescents Report of the Consultative Committee (Hadow Report) London:H.M.S.O.
- Board of Education (1931) The Primary School Report of the Consultative Committee (Hadow Report) London: H.M.S.O.
- Board of Education (1933) Infant and Nursery Schools Report of the Consultative Committee, London: H.M.S.O.
- Board of Education (1933) Handbook of Suggestions on Health Education London: H.M.S.O.
- Board of Education (1937), Handbook of Suggestions for the consideration of teachers and others concerned in the work of Public Elementary Schools London: H.M.S.O.
- Board of Education (1942), Handbook of Suggestions for the consideration of teachers and others concerned in the work of Public Elementary Schools London: H.M.S.O.
- Board of Education (1944) Report of a Committee appointed by the President of the Board of Education to consider the Supply, Recruitment and Training of Teachers and Youth Leaders (McNair Report) H.M.S.O, London
- Booth, C., (1902) Life and Labour of the People in London, London: Macmillan (Reprinted 1902-3)
- Booth, C. (1902) Life and labour of the people in London First Series. Poverty (3) London: Macmillan
- Booth, C. (1902) Life and labour of the people in London Final Volume London: Ams Press
- Booth, P.R., (1990) Ecology in the National Curriculum: a practical guide to using school grounds Winchester, Hants.: Learning Through Landscapes Trust
- Borg, W.R (1963), Educational Research New York: Longman.
- Boschhuizen, R. (1990) 'The concept of photosynthesis and pupils' ideas on the concept of 'cycles'' in Voorbach M.T. and Prick L.G.M., Teacher Education 6, Research and developments in teacher education in the Netherlands.
- Boud, D., Keogh, R. and Walker, R. (eds.) (1985) Turning Experience into Learning London: Kogan Page
- Bourne, A. (1942) Health of the Future London: Penquin
- Brinkman, F. and Boschhuizen, R. (1989) 'Preinstructional ideas in biology: a survey in relation with different research methods on concepts of health and energy' in Voorbach M.T. and Prick L.G.M., Teacher Education 5, Research and developments in teacher education in the Netherlands: 75-90

- British Association (1935) Britain in Depression A Report prepared for the British Association London: Pitman
- British Gas (1987) Energy in the School Curriculum: Conference Report on Conference organised by British Gas in association with the Energy Efficiency Office, to consider the place of energy efficiency studies in the school curriculum, January 1987. British Gas
- British Medical Association (1933) Report of the Committee on Nutrition 1933 London: B.M.A.
- British Pediatric Association (1987) The School Health Services London: British Pediatric Association
- Brook, A. and Driver, R. (1984) Aspects of Secondary Students Understanding of Energy: Full Report Children's Learning in Science Project, Centre for Studies in Science and Mathematics Education, University of Leeds.
- Bruce, M. (1965) The Coming of the Welfare State London: Batsford Press
- Bruce, M. (1973) The rise of the welfare state - English Social Policy 1601 - 1971 London: Weidenfeld and Nicolson
- Brumby, M.N. (1982) 'Students perception of the concept of life' Science Education 66(4) 613-622
- Brumby, M., Garrard, J. and Auman, J., (1985) 'Students' perceptions of the concept of health' European Journal of Science Education Vol.7, No.3, pp. 307-323
- Bruner, J.S. (1960) The Process of Education Cambridge Mass: Harvard University Press
- Bruner, J.S. (1966) Towards a theory of instruction Harvard: Belknap Press
- Burgess, A., (1961) 'Nutrition Education in Public Health Programmes - What have we learned?' American Journal of Public Health Vol.51, No.11, pp. 1715-1725
- Burgess, R.G., (ed) (1982) Field Research: A Source Book and Field Manual London: Allen and Unwin
- Burnett, J. (1966) Plenty and Want - A social history of diet in England from 1815 to the present day London: Nelson
- Burnett, J. (1967) 'Plenty and want: a social history of English diet from 1815 to the present day' Nutrition Vol.21, pp.7-19
- Cade, A. (1988) Science for Survival Plants and Rainforests in the Classroom Richmond: Richmond Publishing Co.Ltd.

- Callaghan, D.L., (1971) 'Focus on nutrition: you can't teach a hungry child' School Food Journal (U.S.A.) September, p. 25
- Callow, A.B. (1938) Food and Health An introduction to the science of nutrition. Oxford: Oxford University Press
- Calloway, D.H., Gordon, H.F., Grodner, M.S. and Pye, O., (1979) Position of Nutrition Education within Education Systems Paris: Unesco
- Cameron, Allan.G. and Collymore, Y. (1979) The Science of Food and Cooking London: Edward Arnold
- Carey, S. (1985) Conceptual Change in Childhood Cambridge, Massachusetts: MIT press
- Carpenter, K.J., (1988), The History of Scurvy and Vitamin C Cambridge: Cambridge University Press
- Cathcart, E.P. and Murray, A.M.T.. (1932) Studies in Nutrition An Inquiry into the diet of Families in Reading and Cardiff London: H.M.S.O
- Cavendish, S., Galton, M., Hargreaves, J. and Harlen, W. (1990) Assessing Science in the Primary Classroom - Observing Activities London: Paul Chapman
- Chery, A., Henderson Sabry, J. and Woolcott, D.M., (1987) 'Nutrition Knowledge and Misconceptions of University Students: 1971 vs. 1984' Journal of Nutrition Education Vol.19, No.5, pp. 237-241
- Children's Learning in Science (1987) CLIS in the classroom: approaches to teaching plant nutrition Leeds University: Centre for Studies in Science and Mathematics Education
- Chilver, P. and Gould, G. (1982) Learning and Language in the Classroom: Discursive Talking and Writing Across the Curriculum Oxford: Pergamon Press
- Christian-Carter, J., (1980) Curriculum Development in the Field of Nutrition: A Process-product study M.Phil. thesis University of Nottingham.
- Church, M.A., (1977) 'Nutrition education as an aspect of nutrition intervention: basis, approaches and methodology' Paper given at Bogota Course on Nutrition Plans, Policies and Programs
- Church, M. and Doughty, J. (1976) 'Value of traditional food practices in nutrition education' Journal of Human Nutrition Vol.30 pp.9-12
- Clarke, J.S., (1949) The break-up of the Poor Law in Cole, M. (ed.) The Webbs and Their Work M.Cole (ed.) London: Frederick Muller pp.101-117

- Clough, E.E., Driver, R. and Wood-Robinson, C., (1987) 'How do children's scientific ideas change over time?' School Science Review Vol.69, No.247, pp.255-267
- Cohen, L. and Manion, L. (1986), Research Methods in Education London: Croom Helm
- Cole, M.I., (ed.) (1949) The Webbs and their Work, London: Frederick Muller.
- Combes, L.J., (1988) 'What do children know?' Health Education Journal Vol.47, Nos. 2-8, p.81-82
- Committee on Catering Arrangements in Schools Report (1975) London: H.M.S.O.
- Committee on Child Health Services , (1976), Fit for the future Report of the Committee on Child Health Services (Court Report) Vols.1 and 2 London: H.M.S.O.
- Committee of Council on Education (1899) Report 1889-9 Cd.9401. London: H.M.S.O
- Committee on Medical Aspects of Food (1984) Diet and Cardiovascular disease London: H.M.S.O
- Contento, I., (1979) 'Overview of Nutrition Education and Information Programs for Children and Adolescents' Paper prepared for National Conference on Nutrition Education, Washington, D.C. September 1979
- Contento, I., (1981), 'Children's Thinking about Food and Eating - A Piagetian-Based Study' Journal of Nutrition Education Vol.13 No.1; Supplement S 86-90
- Contento, I.R. and Michela, J.L (1981), 'Spontaneous Classification of Foods by Children at Varying Cognitive Development Levels' Paper presented at the Annual Meeting of the Society for Nutrition Education, San Diego, August 1981
- Cook, C.B., Eiler, D.A. and Kaminaka, E.C. (1977) ' How much nutrition knowledge in grades K-6?' Journal of Nutrition Education Vol.9; 131-135
- Coronary Prevention Group (1987) Diet or Disease? The case for school meals guidelines Report of a Working Party convened by the Coronary Prevention Group London: Assistant Masters and Mistress Association in conjunction with The Coronary Prevention Group.
- Cosgrove M. and Osborne R. (1985) 'Lesson frameworks for changing children's ideas' in Osborne, R and Freyberg P (eds) Learning in Science - the implications of children's science London: Heinemann
- Cowley, J., David, K. and T. Williams (eds) (1981) Health Education in Schools Harper and Row (first edition)

- Cox C.B. and Dyson, A.E.(eds.) (1969) Fight for Education
A Black Paper London: The Critical Quarterly Society
- Crawford, W. and Broadley, H. (1938) The People's Food
London: Heinemann
- Curtis, S.J., (1967) History of Education
London: University Tutorial Press
- Curtis, S.J. and Boulwood, M.E.A. (eds) (1970) An
introductory History of English Education since 1800
London: University Tutorial Press
- Daniel, M.V. (1947) Activity in the Primary School
Oxford: Basil Blackwell
- Dalzell-Ward, A.J. (1975) A Textbook of Health Education
London: Tavistock Publications
- David, K. and Williams, T. (eds.) (1987) Health Education in
Schools London: Harper and Row (second edition)
- Davies, J., Prendergast, S., Prout, A. and Tuckett, D.,
(1982) Health knowledge of schoolchildren, their
parents and teachers Final Report of the Schools
Council Health Education Project Cambridge: Health
Education Studies Unit
- Deadman, J.A. and Kelly, P.J. (1978) 'What do secondary
school boys know about evolution and heredity before
they are taught the topics?' Journal of Biological
Education, Vol 12, No.4 pp.7-15
- Dent, H.C. (1982) Education in England and Wales
London: Hodder and Stoughton
- Department of Education and Science (1966) Annual Report:
School Meals Service London: H.M.S.O.
- Department of Education and Science (1967) Annual Report
London: H.M.S.O. (also Reports for 1968, 1969, 1970,
1971, 1972, 1973, 1974, 1975)
- Department of Education and Science (1967) Children and
their Schools (Plowden Report) Report of the Central
Advisory Council for Education. London: H.M.S.O.
- Department of Education and Science (1972) Report of a
Committee of Enquiry into Teacher Education and
Training (James Report) H.M.S.O., London
- Department of Education and Science (1975a), The School
Health Service 1908 - 1974 Report of the Chief Medical
Officer of the Department of Education and Science and
presenting an historical overview by Dr.Peter
Henderson, Principal Medical Officer of the Department
of Education and Science from 1951 - 1974.
London: H.M.S.O.

- Department of Education and Science (1975b), Nutrition in Schools Report of the Working Party on the Nutritional Aspects of School Meals. London: H.M.S.O.
- Department of Education and Science (1977a) Education in Schools: a consultative document London: H.M.S.O.
- Department of Education and Science (1977b) Health Education in Schools London: H.M.S.O.
- Department of Education and Science (1978a) Primary Education in England: a survey by HM Inspectors of Schools London: H.M.S.O.
- Department of Education and Science (1978b) Girls and Science HMI Series: Matters for Discussion 13 London: H.M.S.O.
- Department of Education and Science (1978) Curriculum 11-16 Working papers by HM Inspectorate: a contribution to current debate. London: H.M.S.O.
- Department of Education and Science (1979) A Framework for the School Curriculum London: H.M.S.O.
- Department of Education and Science (1979) Aspects of Secondary Education in England HMI Report London: H.M.S.O.
- Department of Education and Science (1980a) A View of the Curriculum HMI Series: Matters for Discussion 11 London: H.M.S.O.
- Department of Education and Science (1980b) Girls and Science London: H.M.S.O.
- Department of Education and Science (1981) The School Curriculum London: H.M.S.O.
- Department of Education and Science (1982) Science Education in Schools: a Consultative Document London: DES
- Department of Education and Science (1983a) Discussion paper on Science in primary education HMI Science Committee H.M.S.O. London
- Department of Education and Science (1983b) Circular 11/83
- Department of Education and Science (1983c) 9 - 13 Middle Schools London: H.M.S.O.
- Department of Education and Science (1984) Circular 4/84
- Department of Education and Science (1985a) Science 5 - 16: a statement of policy London: H.M.S.O
- Department of Education and Science (1985b) Circular 3/85

- Department of Education and Science (1985c) Better Schools
Command 9469 London: H.M.S.O
- Department of Education and Science (1985d) Better schools:
a summary London: Department of Education and Science
and Welsh Office
- Department of Education and Science (1985e) Education 8 -
12 in Combined and Middle Schools London: H.M.S.O.
- Department of Education and Science (1986) Health Education
from 5 to 16 Curriculum Matters 6 HMI Discussion
Series London: H.M.S.O.
- Department of Education and Science (1987) Primary Schools
some aspects of good practice An HMI publication
London: H.M.S.O
- Department of Education and Science (1987) The National
Curriculum 5 -16: a consultation document July 1987
London: Department of Education and Science and the
Welsh Office
- Department of Education and Science (1988a) Science for
ages 5 to 16 London: H.M.S.O.
- Department of Education and Science (1988b) Report by the
Task Group on Assessment and Testing
London: H.M.S.O
- Department of Education and Science, (1989a) Science in the
National Curriculum London: H.M.S.O.
- Department of Education and Science (1989b) The Curriculum
from 5 to 16 Curriculum Matters 2 An HMI Series
Second edition (incorporating responses)
London: H.M.S.O.
- Department of Education and Science (1989c) Personal and
Social Education from 5 to 16 HMI Curriculum Matters
Series 14 London: H.M.S.O.
- Department of Education and Science (1989d) National
Curriculum: From Policy to Practice Stanmore: D.E.S.
- Department of Education and Science (1989e) Aspects of
Primary Education: The Teaching and Learning of
Science HMI Report London: H.M.S.O.
- Department of Education and Science (1989f) Technology for
Ages 5 to 16 London: H.M.S.O.
- Department of Education and Science (1990) Technology in
the National Curriculum London: H.M.S.O.
- Department of Education and Science (1991a) Science for
ages 5 to 16 (1991) London: H.M.S.O.

- Department of Education and Science (1991b) Science Key Stages 1 and 3 The Implementation of the Curricular Requirements of the Education Reform Act. A Report by H.M. Inspectorate on the First Year, 1989-90 London: H.M.S.O.
- Department of Health and Social Security in conjunction with the British Nutrition Foundation and the Health Education Council (1977) Nutrition Education Report of a Working Party London: H.M.S.O.
- Department of Health and Social Security, (1978) Eating for Health London: H.M.S.O.
- Department of Health and Social Security (1984) Diet and Cardiovascular Disease Report by the Committee on Medical Aspects of Food Policy (COMA Report) Report on Health and Social Subjects No.8, London: H.M.S.O.
- Department of Health (1989) The Diets of British School Children Report on Health and Social Subjects No 36 Committee on Medical Aspects of Food Policy. London: H.M.S.O
- Dent, H.C., (1982) Education in England and Wales London: Hodder and Stoughton
- Donaldson, M. (1978) Children's Minds London: Fontana
- Donaldson, M., Grieve, R. and Pratt, C. (eds.) (1983) Early Childhood Development and Education Readings in Psychology Oxford: Basil Blackwell
- Douglas, M., (1975) Implicit Meanings: Essays in Anthropology London: Routledge and Kegan Paul
- Drake, B., (1936) 'Nutrition, A Policy of National Health' New Fabian Research Bureau, Dec. 1936, No. 31 London: Fabian Society
- Driver, R., (1980) A response to a paper by Michael Shayer in Archenhold, W.F., Driver, R.H., Orton, A. and Wood-Robinson, C. (eds.) Cognitive Development Research in Science and Mathematics Leeds: University of Leeds, pp.80-86
- Driver, R.H., (1981) 'Pupils' alternative frameworks in science' European Journal of Science Education Vol.3 No.1 pp.93-101
- Driver, R.H., (1982) 'Children's learning in science' Educational Analysis Vol.4 No.2 pp.69-79
- Driver, R. (1983) The Pupil as Scientist? Milton Keynes: Open University Press
- Driver, R. (1989) 'Students' conceptions and the learning of science' International Journal of Science Education Vol,11 pp.481-490

- Driver, R. (1991) 'Research in Learning in Science: An International Perspective' paper given at CLISP Learning in Science Conference: Research and Practice, Woolley Hall College, May 1991
- Driver, R., Child, D., Gott, R., Head, J., Johnson, S., Worsley, C., and Wylie, F., (1984) Science in Schools at age 15: Report No.2 Report to the DES, DENI and the Welsh Office on the 1981 survey of 15 year olds. London: Assessment of Performance Unit
- Driver, R. and Erickson G., (1983) 'Theories-in-action: some theoretical and empirical issues in the study of students' conceptual frameworks in science' Studies in Science Education Vol.10 pp. 37 -60
- Driver, R., Guesne, E. and Tiberghien, A.(eds.) (1985) Children's Ideas in Science Milton Keynes: Open University Press
- Driver, R., Wells, P., and Brook, A., (1987) 'Children's understandings and the teaching of energy in schools' in Energy in the School Curriculum Conference Report British Gas pp. 23-38
- Drummond, J.C. and Wilbraham, A., (1939) The Englishman's Food London: Jonathan Cape
- Dudley, S.F., (1953) James Lind: Laudatory Address Proceedings of the Nutrition Society Vol.12 pp. 202-209
- Dunn, K.A., (ed.) (1979) Health education in action: achievements and priorities Report of 10th International Conference on Health Education held in London, September 1979
- Duit, R. (1983) 'Energy conceptions held by students and consequences for science teaching' In Helm, H. and Novak, J.D. (eds.) Proceedings of the International Seminar on Misconceptions in Science and Mathematics New York: Department of Education, Cornell University
- Edema, J. (1985) 'A sociological approach to nutrition education in elementary schools in the Netherlands' in Turner, S.A. and Ingle R.B., (eds.) New Developments in Nutrition Education Nutrition education Series No.11 Paris: Unesco
- Eggleston, J.T., Galton, M.J., and Jones, M.E. Processes and Products of Science Teaching Schools Council Research Studies London: Macmillan Education
- Elfor, P. and Gatiss, S. (1990) Charting Child Health Services A Survey of Community Child Health Services Provided by Health Authorities in England, Scotland and Wales London: National Children's Bureau

- Eisen, Y. and Stavay, R. (1988) 'Students' understanding of photosynthesis' The American Biology Teacher Vol. 50, No.4: pp.208-212
- Eisen, Y. and Stavay, R. (1990) 'Is it possible to study photosynthesis without misconceptions?' Paper presented at ATEE Conference, Limerick, August 1990
- Engineers' Study Group on Economics (1936) Interim Report on the Design of a Family Budget with special reference to food London: Engineers' Study Group
- Ennever, L. and Harlen, W. (1972) With objectives in mind Guide to Science 5/13 London: Macdonald Education for Schools Council
- Ensor, R.C.K., (1949) 'Permeation' in Cole, M.(ed.) The Webbs and Their Work London: Frederick Muller pp. 57-76
- Fensham, P.J.,(1979) 'Conditions for Co-operation and Strategies for Innovation' in Steiner, H.G. (ed.) Co-operation between Science Teachers and Mathematics Teachers Institute fur Didaktik den Mathematik der Universitat Bielfeld, pp. 553-580
- Finch, I. (1978a) 'The Aquarian System', Nutrition and Food Science No.51, March/April, pp. 2-5
- Finch, I. (1978b) 'Teaching Nutrition in Schools' Nutrition and Food Science No.52, May/June, pp. 16-19
- Finch, I (1981) 'Everyday Meal-Choosing Systems for the U.K. Judged by Educational, Psychological and Nutritional Criteria', Journal of Human Nutrition, Vol.35, pp. 106-117
- Finch, I. (1982) Classifying Foods - a first nutrition reference book London: Finch
- Fisher, P.,(1987) History of School Meals in Great Britain Nutrition and Health, Vol 4, pp. 189-194
- Food and Agriculture Organisation (1968) Visual Aids in Nutrition Education Geneva: FAO
- Food and Agriculture Organisation (1977) Dietary fats and oils in human nutrition Report of a joint FAO/WHO Expert Consultation Rome: FAO
- Food and Agriculture Organisation (1980) Carbohydrates in human nutrition Rome: FAO
- Food and Agriculture Organisation (1981) Food and nutrition planning Rome:FAO
- Food and Agriculture Organisation (1981) Bibliography of food consumption Rome: FAO

- Foster, W., (ed) (1940) The Voyages of Sir James Lancaster to Brazil and the East Indies (1591 - 1603) London: Hakluyt Society
- Freckleton, A.M. et al (1989) 'Public Perception and Understanding' in Spedding C.R.W.(ed.) The Human Food Chain London: Elsevier pp.17-57
- Frost J.and Turner, S. (1987) Reflections on DES courses for science coordinators in primary schools Primary Science Review No. 5, pp. 12-15
- Fullard, E. (1981) Dietary Goals for the U.K. in the 1980's Vanden Berghs and Jurgens
- Gagne, R.M. (1985) The Conditions of Learning and the Theory of Instruction New York: Holt, Rinehart and Winston
- Galton, M., Simon,B. and Croll,P., (1980), Inside the Primary Classroom London: Routledge, Kegan and Paul
- Gayford, C.G. (1986) 'Some aspects of the problems teaching about energy in school biology' European Journal of Science Education 8 (4): 443-450
- Gellert, E., (1962) 'Children's conceptions of the content and functions of the human body' Genetic Psychology Monographs 65: 293-405
- Giff, H.H., Washbon, M.B. and Harrison, G.G., (1972) Nutrition, Behaviour and Change New Jersey: Prentice-Hall, Inc.
- Gilbert, B. (1970) British Social Policy 1914 -1939 London: Batsford
- Gilbert, B. (1980) Britain since 1918 London: Batsford (originally published 1967)
- Gilbert, J.K., Osborne, R.J., Fensham P.J. (1982) 'Children's Science and Its Consequences for Teaching' Science Education Vol.66, No.4, pp. 623 - 633
- Gilbert, J.K. and Watts, D.M. (1983) 'Conceptions, misconceptions and alternative conceptions: changing perspectives in science education' Studies in Science Education, 1983 Vol. 10 pp.61-98
- Gipps, C. (1986) 'A critique of the APU' in Assessing Educational Achievement Nuttall D.L. (ed.) Contemporary Analysis in Education Series. London: The Falmer Press
- Gipps, C. (1988), 'What Exams would Mean for Primary Education' in The National Curriculum Lawton, D. and Chitty, C., Bedford Way Papers 33 London: Kogan Page

- Gipps, C. and Goldstein, H., (1983) Monitoring Children - An Evaluation of the Assessment of Performance Unit
London: Heinemann Educational Books
- Gordon, P. and Lawton, D. (1978) Curriculum change in the nineteenth and twentieth centuries
London: Hodder and Stoughton
- Gordon, H.F. and Calloway, D.H. (1977) Position of Nutrition Education within Educational Systems Report to Unesco Paris: Unesco
- Gosden, S., (1987) 'Young children's conception of energy' unpublished paper presented at Association of Science Education Tutors Conference, University of Sussex, September 1987.
- Grant, J.P., (1984) The State of the World's Children 1984
New York: UNICEF
- G.B. (1871) Education Report: Code 1871
- G.B. (1875) Education Report: Code 1875
- G.B. (1882) Education Report: Code 1882
- G.B. (1887) Education Annual Report: Code 1887
- G.B. (1895) Education Annual Report: Code 1895
- G.B. (1896) Education Annual Report: Code 1896
- G.B. (1899) Education Annual Report: Code 1899
- G.B. (1899) Board of Education Act
- G.B. (1903) Education Act, 1902
- G.B. (1903) Education Act
- G.B. (1906) Education (Provision of Meals) Act
- G.B. (1907) Education (Administrative Provisions) Act
- G.B. (1914) Education Act, 1914
- G.B. (1936) Education Act, 1936
- G.B. (1944) Education Act, 1944
- G.B. (1980) Education Act, 1980
- G.B. (1988) Education Reform Act
- Green, M.E. (1934) Evidence on Malnutrition Report submitted to the Unemployment Assistance Board on Behalf of the Children's Minimum Campaign Committee
London: Children's Minimum Campaign Committee

- Griffin, G.A. and Light, L.L. (1975) Nutrition Education Curricula: relevance, design and the problem of change Educational Studies Document Series No.18 Paris: Unesco
- Griffiths A.K. and Grant, B.A.C. (1985) 'High School Students' Understanding of Food Webs: Identification of a Learning Hierachy and Related Misconceptions' Journal of Research in Science Teaching 22(5): 421-436
- Guild of Food Writers/Coronary Prevention Group (1991) Eat well...live well London: Coronary Prevention Group
- Guruge A. (ed.) (1986) School Feeding Programmes as a Potential Source of Learning Paris/New Delhi: Unesco/Unicef
- Gussow, J.D., (1983) 'The role of nutrition education in the improvement of human nutrition' in Nutrition Education: Relevance and Future Unesco Science and Technology Education Document Series No.5. Paris: Unesco pp. 13-23
- Halsey, A.H. (1972) Educational Priority: Volume 1: E.P.A. Problems and Policies H.M.S.O., London
- Harlen, W., (1975) Science 5-13: a Formative Evaluation Schools Council Research Studies, London: Macmillan Education
- Harlen, W. (1978) 'National Assessment of Scientific Attainments' Studies in Science Education Vol.5 pp.143-150
- Harlen, W., (1982) New trends in primary school science education Vol.1 Paris: Unesco
- Harlen, W. (ed) (1983) The training of primary science educators - a workshop approach Paris: Unesco
- Harlen, W. (1985) Teaching and Learning Primary Science London: Harper and Row
- Harlen, W. (ed) (1985) An International Workshop on Primary Science - Bangalore Conference Report. University of Liverpool
- Harlen, W.(ed.) (1985) Taking the Plunge London: Heinemann Educational Books
- Harlen, W. (1986) Planning Scientific investigations at Age 11 Assessment of Performance Unit Report for Teachers, London: D.E.S.
- Harlen, W., Black, P., and Johnson, S. (1981) Science in Schools Age 11: Report No. 1. London: H.M.S.O for the Assessment of Performance Unit

- Harlen, W., Black, P., Johnson, S. and Palacio, D., (1983) Science in Schools Age 11: Report No. 2. London: Department of Education and Science for the Assessment of Performance Unit
- Harlen, W., Black, P., Johnson, S., Palacio, D., and Russell, T., (1984) Science in Schools Age 11: Report No.3 London: H.M.S.O for the Assessment of Performance Unit
- Harlen, W., Black, P., Khaligh, N., Palacio, D., and Russell, T., (1985) Science in Schools Age 11: Report No.4 London: H.M.S.O for the Assessment of Performance Unit
- Harlen, W. Darwin, A. and Murphy, M. (1977) Match and Mismatch - Raising Questions Edinburgh: Oliver and Boyd for the Schools Council
- Harlen, W. Darwin, A. and Murphy, M. (1977) Match and Mismatch - Finding Answers Guide to Diagnosis and Development. Edinburgh: Oliver and Boyd for the Schools Council
- Harper, A.E., (1969) 'Nutrition: Where are we?' American Journal of Clinical Nutrition Vol.22 pp. 87-98
- Harrison, G.A. (ed.) Energy and Effort London: Taylor and Francis
- Hastings, S., (1934) A National Physiological Minimum Fabian Tract Series. Jan 1934 No.211. London: Fabian Society
- Haughton, B., Gussow, J.D. and Dodds, J.M. (1987) 'An Historical Study of the Underlying Assumptions for United States Food Guides from 1917 through the Basic Four Group Guide' Journal of Nutrition Education Vol.19, No.4, pp.169-175
- Hayes, M. (ed.) Starting Primary Science London: Edward Arnold
- Health Education Authority (1989) Guide to Healthy Eating London: Health Education Authority
- Health Education Authority (1989) Do you take sugar? London: Health Education Authority
- Health Education Authority (1990), Exploring Health Education London: Health Education Authority/Macmillan Education
- Health Education Authority/Sports Council (1990) Exercise, why bother? London: Health Education Authority
- Health Education Council (1983) My Body London: Heinemann Educational

- Hebden, R., Jones, M., Parsons, C., and Walsh, B. (1977) 'How Does Innovation Take Root in Schools?' British Journal of In-Service Education, Vol. 4, No. 1 Winter 1977, pp.50-53
- Her Majesty's Inspectorate (1985) The Curriculum from 5 to 16 Curriculum Matters 2 London: DES
- Her Majesty's Inspectorate (1985) Home Economics from 5 to 16 Curriculum Matters 5 London: DES
- Her Majesty's Inspectorate (1986) Health Education from 5 to 16 Curriculum Matters 6 London: DES
- Her Majesty's Inspectorate (1989) Personal and Social Education from 5 to 16 Curriculum Matters 14 London: DES
- Her Majesty's Inspectorate (1990) Health Education from 5 to 16 Curriculum Matters 6 The Responses London: DES
- Hertzler, A.A. and Anderson, H.L., (1974) 'Food guides in the United States. An historical review' Journal American Dietetic Association Vol.64, Jan. pp.19-28
- Heubner, D. (ed.) (1964) in A reassessment of the curriculum New York: Teachers College Press
- Hochbaum, G.M.(1979) 'Nutrition behaviour and education' In Levy, R. (ed.) Nutrition, lipids and coronary heart disease New York: Raven Press pp. 365-390
- Hochbaum, G.M.(1981) 'Strategies and Their Rationale for Changing People's Eating Habits' Journal of Nutrition Education Vol.13 No.1 S. pp. 59-65
- Hoffman, C.J. (1986) 'Using Computer Programs and Learning Activities to Teach the Dietary Guidelines to Elementary Students' Journal of Nutrition Education Vol.19 No.20C Gem No.73
- Holland, J., (1981) 'Social Class and changes in orientation to meaning' Sociology Vol. 15 No.1, pp. 1-18
- Hollingsworth, D., (1977) 'Translating Nutrition Into Diet' Food Technology February 1977, pp. 38-44
- Hollingsworth, D., (1983a) 'Rationing and Economic Constraints on Food Consumption in Britain since the Second World War' World Review of Nutrition and Dietetics Vol.42, pp.191-218
- Hollingsworth, D.,(1983b), 'Nutrition Education' in Mc.Loughlin, V. and McKenna, B.M. (eds.) Proceedings of the Sixth International Congress of Food Science and Technology Dublin, September 1983 pp.283-292

- Hollingsworth, D., (1985) 'Nutrition Education - the work of the International Union of Nutritional Sciences' in Turner, S.A. and Ingle, R.B.(eds.) New Developments in Nutrition Education Nutrition Education Series Issue 11, Paris: Unesco.
- Holmes, F.L., (1975) 'The transformation of the science of nutrition' Journal of Historical Biology Vol.8, No.1, pp.135-144
- Hooper, R.(ed.) (1971) The Curriculum: Context, Design and Development Edinburgh: Oliver and Boyd
- Hopkins, F.G. (1906) 'The Analyst and the Medical Man' The Analyst, No.31 p.385
- Hoyle, E., (1969) The Role of the Teacher London: Routledge and Kegan Paul
- Hoyle, E., (1971) 'How does the curriculum change?' in Hooper. R. (ed.) The Curriculum; Context Design and Development Edinburgh: Oliver and Boyd
- Hurren, C. and Black, A., (1991) The Food Network: achieving a healthy diet by the year 2000 London: Smith-Gordon
- Hutchinson, R.,(1907) Scurvy (scorbutus). In Osler's Modern Medicine pp 893-907 Philadelphia,P.A.: Lea Brothers and Co.
- Inner London Educational Authority (1979) Food: a resource for learning in the primary school London: ILEA
- Inner London Educational Authority (1985) Nutrition Guidelines Heinemann Educational Books
- Inner London Educational Authority (1985) Health Education: an aspect of the primary curriculum London: ILEA
- Ingle R.B. and Turner S.A.(1982) 'Relevance in nutrition education' in Nutrition Education: Relevance and Future Unesco Science and Technology Education Document Series No.5. Paris: Unesco pp 3-11
- Inhelder, B. and Piaget, J.(1964) The Early Growth of Logic in the Child: Classification and Seriation London: Routledge and Kegan Paul
- IPSE (Initiatives in Primary Science: An Evaluation) (1988) Report Implementing Primary Science Education Series Hatfield: Association for Science Education
- IPSE (1988) The School in Focus Implementing Primary Science Education Series Hatfield: Association for Science Education
- IPSE (1988) Building Bridges Implementing Primary Science Education Hatfield: Association for Science Education

- IPSE (1988) Snapshots Implementing Primary Science Education Hatfield: Association for Science Education
- Inner London Education Authority (1979) Food - a resource for learning in the primary school London: ILEA
- Inner London Education Authority (1985) Nutrition Guidelines London: ILEA Learning Resources and Heinemann
- International Union of Nutritional Sciences/Unesco (1974) Report on Consultation on Nutrition Education Paris: Unesco
- IUNS/Unesco, (1974) Report on Consultation on Nutrition Education Paris: Unesco
- Jahoda, G. and Crammond, J. (1972) Children and Alcohol: A Development Study in Glasgow, Vol.1. London: H.M.S.O.
- Jenkins, E.W. (1979) From Armstrong to Nuffield Studies in twentieth-century science education in England and Wales. London: John Murray
- Johnson, V., (1981) 'Health Education in Primary Schools' in Cowley, J. et al (eds.) Health Education in Schools London: Harper and Row pp.75-107
- Kalina, B.B., Philipps, C.A. and Minns, H.V. (1989) 'The NET Program: A Ten-Year Perspective' Journal of Nutrition Education Vol.21, No.1, pp.38-42
- Keddie, N. (1971) 'Classroom Knowledge' in Young, M.F.D., (ed.) (1971) Knowledge and Control: New Directions for the Sociology of Control London: Collier-Macmillan pp.133-160
- Kelly, P.J., and J.L.Lewis (eds.) (1987) Education and Health Science and Technology Education and Future Human Needs, Vol. 5. Oxford: Pergamon Press for the ICSU Press
- Kent, G. (1988) 'Nutrition Education as an Instrument of Empowerment' Journal of Nutrition Education Vol.20, No.4, pp. 193-195
- Kitchen, P., (1990), For Peace and Country; War, Peace and Rural Life as seen through the pages of the W.I.Magazine 1919-1959 London: Ebury Press
- Kubli, F., (1983) 'Piaget's clinical experiments: A critical analysis and study of their implications for science teaching' European Journal of Science Education Vol.5, No.2, pp 123-139

- Korthagen A.J. and Wubbels, T. (1991) 'Characteristics of Reflective Practitioners: towards an operationalization of the concept of reflection'. Paper presented at the Annual Meeting of the American Educational Research Association, April 1991, Chicago.
- Labour Party, (1936) Nutrition and Food Supplies and Women in Offices Reports presented at the National Conference of Labour Women, Swansea, May 1936 London: Labour Party
- Lambert, R. Sir John Simon and English Social Administration London: MacGibbon
- Lawton, D. (1981) An Introduction to the Teaching and Learning Studies in Teaching and Learning. London: Hodder and Stoughton
- Lawton, D., Gordon, P., Ing, M., Gibby, B., Pring, R. and Moore, T. (1978) Theory and Practice of Curriculum Studies London: Routledge and Kegan Paul
- Lawton, D. and Chitty, C. (eds.) (1988) The National Curriculum University of London: Bedford Way Series
- Learning Through Science (1980) Learning Through Science: Formulating a School Policy London: Macdonald Educational
- Learning Through Science (1980) Science Resources London: Macdonald Educational
- Leeds National Curriculum Science Support Project (1991) Nutrition - Research Survey (personal communication, in press)
- Leff, S. and Leff, V. (1959) The School Health Service London: H.K. Lewis
- Le Gros Clarke, F., (1947) Feeding the Human Family London: Sigma Books
- Lewis, J. (1986) Labour and love: Woman's experience of home and family London: Blackwell
- Liebig, J. von, (1842), Animal Chemistry London: Taylor and Walton
- Light, P., Sheldon, S. and Woodhead, M. (eds.) (1991) Learning to Think Child Development in Social Context 2. London and New York; Routledge in association with the Open University
- Lindemann, A.K. and Clancy, K.L. (1990) 'Assessment of Breakfast Habits and Social/Emotional Behaviour of Elementary Schoolchildren' Journal of Nutrition Education Vol.22, No.5, pp.226-231

- Lloyd, G.E.R., (ed.), (1978) Hippocratic Writings
London: Penguin Books
- Lucas, A. (1987) 'Public knowledge of biology' Journal of Biological Education Vol. 21, No.1 pp. 41-45
- Mackintosh, J.M. (1953) Trends of Opinion about the Public Health 1901-1951 University of London Heath Clark Lecture 1951. Oxford: Oxford University Press
- Maclure J.S. (1986) Educational documents England and Wales 1816 to the present day. London and New York: Methuen
- Maclure, S. (1988) Education Reformed - A Guide to the Education Reform Act 1988 Sevenoaks: Hodder and Stoughton
- McBriar, A.M., (1949), 'Sidney Webb and the L.C.C., in Cole, M. (ed.) The Webbs and Their Work London: Frederick Muller.
- McCollum, E.V. (1957) A History of Nutrition London: Houghton Mifflin
- Magarey, A., Worsley, A., and Boulton, J. (1986) 'Children's thinking about food: 1. Knowledge of nutrients' Journal of Food and Nutrition Vol.43, No. 1, pp.1-9
- Magarey, A., Worsley, A., and Boulton, J. (1986) 'Children's thinking about food: 2. Concept development and beliefs' Journal of Food and Nutrition Vol.43, No. 1, pp.9-16
- Mariani M.C. and Ogborn, J. (1991) 'Towards an ontology of common - sense reasoning' International Journal of Science Education Vol.13, No.1, pp. 69-85
- Meicklejohn, A.P., (1954) The curious obscurity of Dr James Lind J.Hist.Med.Allied.Sci. Vol. 9, pp. 304-10
- Middleton, J.S. (1949), 'Webb and the Labour Party' in Cole. M. (ed.) The Webbs and their Work London: Frederick Muller. pp. 167-186
- Miel, A. (1964) 'Reassessment of the curriculum - why?' in Heubner, D.(ed.) A reassessment of the curriculum D.Heubner (ed) New York: Teachers College Press
- Miller, R. and Driver, R. (1987) 'Beyond Process' Studies in Science Education 4, pp. 53-62
- Ministry of Education (1959) Primary Education: Suggestions for the Consideration of Teachers London: H.M.S.O.
- Ministry of Education (1961) Science in the Primary School Pamphlet 42. London: H.M.S.O.
- Ministry of Health (1904) Taylor Report 1904 London: Ministry of Health

- Ministry of Health (1937) Report by Advisory Committee on Nutrition London: H.M.S.O.
- Ministry of Health (1945) On the State of Public Health During Six Years of War Report of the Chief Medical Officer of Health, 1939-45 (Sir Wilson Jameson) London: H.M.S.O
- Ministry of Health (1963) Health Education Report of a Joint Committee of the Central and the Scottish Health Services Councils, London: H.M.S.O.
- Ministry of Health (1973) Report on School Meals Provision London: Ministry of Health
- Minns, R., (1980), Bombers and Mash; the Domestic Front 1939-45 London: Virago
- Mintzes J.J., (1984) 'Naive theories in biology: Children's concepts of the human body' School Science and Mathematics Vol.84, No.7, pp. 548-555
- Moore, T., (1965) 'Forty years of nutrition research' Royal Society of Health Journal Vol.85, pp. 185-190
- Morgan, A.F., (1967) 'Landmarks of a half-century of nutrition research' Journal of Nutrition Vol.91, Supplement, 1 February, pp.65-67
- Mouly, G.J., (1978) Educational Research: the Art and Science of Investigation Boston: Allyn and Bacon
- Mowat, C.L. (1955) Britain Between the Wars (1918-1940) London: Methuen
- Munro, H.N.,(1964) 'The origin and growth of our present concepts of protein metabolism' in Munro H.N., and Allison J.B. (eds.) Mammalian Protein Metabolism Vol 1. New York: Academic Press
- Munro, H.J. and Allison, J.B., (1964) Mammalian Protein metabolism Vol. 1. New York: Academic Press.
- Murcott, A. (ed) (1985) The Sociology of Food and Eating Essays on the sociological significance of food. Cardiff: Gower Reprint
- Murphy. J., (1972) The Education Act 1870: Text and commentary Newton Abbot: David and Charles
- National Advisory Council on Nutrition Education (1983), Proposals for Nutritional Guidelines for Health Education in Britain A Discussion Paper, London: Health Education Council
- National Children's Bureau (1987) Investing in the Future; Child Health ten years after the Court Report A report of the Policy and Practice Review Group, London: National Children's Bureau

- National Children's Home (1991) Poverty and Nutrition Survey London: National Children's Home
- National Curriculum Council, (1990a), Curriculum Guidance 3: The Whole Curriculum York: National Curriculum Council
- National Curriculum Council, (1990b), Curriculum Guidance 5: Health Education York: National Curriculum Council
- Nestle, M. (1988) 'The Surgeon General's Report on Nutrition and Health: New Federal Dietary Guidance Body' Journal of Nutrition Education Vol.20, No.5 pp.252-253
- Newman, G. (1939) The Building of a Nation's Health London: MacMillan
- Newsome, S. (1983) 'The Design of Nutrition Education Programmes for multi-ethnic classrooms with special reference to the food beliefs and behaviour of adolescents'. M.Phil thesis, Institute of Education University of London
- Nichter, M. (1981) An Anthropological Approach to Nutrition Education Washington: INCS
- Nitzke, S.A. (1987) 'A Snapshot Summary of Nutrition Education Research in Progress' Journal of Nutrition Education Vol.19, no.6 pp.266-267
- Norman, R.E. (1974) 'Ideas for teaching nutrition' Journal of Home Economics Sept.1977 pp.44-46
- Nuffield Junior Science, (1967) Teachers' Guide 1 London: Collins for The Nuffield Foundation
- Nuffield Home Economics (1977) Teachers' Guide to the Basic Course London: Hutchinson
- Nuttall, D. (ed.) Assessing Educational Achievement Contemporary Analysis in Education Series. London and Philadelphia: The Falmer Press
- O'Connell L., Shannon, B. and Sims, L. (1981) 'Assessing Nutrition-Related Attitudes and Beliefs of Teachers' Journal of Nutrition Education Vol.13 No.1 Supplement pp.81-85
- Oddy, D.J., (1970) 'Food in nineteenth century England - nutrition in the first urban society' Proceedings Nutrition Society Vol. 29, pp. 150-157
- Oddy, D.J. (1970) 'Working Class Diets in Late Nineteenth Century Britain' Economic History Review 2nd.Series XXIII p.322

- Oddy, D.J. (1976) 'A Nutritional Analysis of Historical Evidence: The Working Class Diet 1880-1914' in Oddy, D.J. and Miller, D.S. (eds.) The Making of the Modern British Diet London: Croom Helm pp.214 - 227
- Oddy ,D.J. and Miller, D.S. (eds.) (1976) The Making of the Modern British Diet London: Croom Helm
- Oddy, D.J. and Yudkin, J. (1969) 'An evaluation of English diets of the 1860's' Proceedings of the Nutrition Society Vol.28, pp.13A-14A
- Open University (1985), Healthy Eating Open University Guide to Healthy Eating in Association with the Health Education Council and the Scottish Health Education Group, London: Rambletree Pelham
- Orr, J.Boyd, (1936) Food, Health and Income A Survey of Diet in Relation to Income, London: Macmillan
- Orr, J.Boyd, (1940) Nutrition in War New Fabian Research Bureau Report No.25 London: Fabian Society
- Orr, Lord, J. Boyd (1966) As I Recall London: MacGibbon and Kee
- Osborne R.(1980) 'Some aspects of students' views of the world' Research in Science Education Vol.10 pp.11-18
- Osborne, R. (1985) 'Children's own concepts' in Harlen.W (ed.) Taking the Plunge London: Heinemann Educational Books
- Osborne R.J. and Cosgrove M.N., (1983) 'Children's conceptions of the changes of state of water' Journal of Research in Science Teaching Vol.20 pp. 825 - 838
- Osborne, R and Freyberg, P (eds.) (1985) Learning in Science -the implications of children's science London: Heinemann
- Osborne, R. and Gilbert. J. (1980) ' A technique for exploring students' views of the world' Physics Education Vol.56 No.6 pp. 276-379
- Osborne, R.J. and Wittrock, M.C. (1983) 'Learning science: a generative process' Science Education Vol.67, No.4 pp.489-508
- Passmore, R., Hollingsworth, D. and Robertson, J., (1979) 'Prescription for a better British diet' British Medical Journal Vol.1, pp. 527-531
- Patten, M., (1985) We'll eat again London: Hamlyn
- Pease, E.R. (1949) 'The Webbs and the Fabian Society' in Cole, M. (ed.) The Webbs and their Work London: Frederick Muller pp.17 - 28

- Pereira, J., (1843) A Treatise on Food and Diet
London: Longman
- Peters, J., (1980) 'Teaching nutrition in schools: do our students practice what we teach?' Cajanas Vol.13, No.2 p.77
- Peters, R.S.(ed.), (1968) Perspectives on Plowden
London: Routledge and Kegan Paul
- Peterson M.E.and Kies C.,(1972) 'Nutrition knowledge and attitudes of early elementary school teachers' Journal of Nutrition Education Vol.1 11 - 15
- Piaget, J.(1929) The child's conception of the world
London: Routledge and Kegan Paul
- Piaget, J.(1951) The child's conception of the world
London: Routledge and Kegan Paul
- Piaget, J.(1955) The Construction of Reality in the child
London: Routledge and Kegan Paul
- Piaget, J. and Inhelder, B. (1969) The Psychology of the Child London: Routledge and Kegan Paul
- Picardi, S.M. and Porter, D. (1976) 'Multidimensional evaluation of a food and nutrition minicourse' Journal of Nutrition Education Vol.8 pp.162-168
- Politics of Health Group (1980) Food and Profit - it makes you sick London: Blackrose Press
- Poolton, M.A. (1972) 'Predicting Applications of Nutrition Education' Journal of Nutrition Education Summer 1972 p.110
- Pope, M. (1982) 'Personal Construction of Formal Knowledge' Interchange Vol.13, No.4 pp.3-14
- Pope, M. and Gilbert, J. (1983a) 'Personal experience and the construction of knowledge in science' Science Education Vol.67, No.2 pp. 173-203
- Pope, M. and Gilbert, J. (1983b) 'Constructive Science Education' paper presented at Personal Construct Psychology Conference, Boston
- Poulton, M.A. (1972) 'Predicting Application of Nutrition Education' Journal of Nutrition Education Summer 1972 p.110
- Pring, R. (1989) The New Curriculum
London: Cassell Education
- Pye, O.F., (1976) 'Retrospects and Prospects in Nutrition Education' Journal of Nutrition Education Vol.8, No.4, pp.154-155

- Pyke, M. (1975) Success in Nutrition London: John Murray
- Pyke, M. (1981) Food Science and Technology
London: John Murray (4th edition)
- Rao, A.N., (ed.) (1987) Food, Agriculture and Education
Science and Technology Education and Future Human
Needs, Vol. 6 London: Pergamon Press
- Rathbone, E.F., (1934) Memorandum on Minimum Needs:
submitted on behalf of the Children's Minimum Campaign
Committee, July, 1934. London: Children's Minimum
Campaign Committee
- Raw, I. (1977) 'Processus de definition des besoins:
Question de la pertinence de l'education' Conference
Report International Conference on Nutrition Education
Oxford, 1977
- Resnicow, K. and Reinhardt, J. (1991) 'What Do Children
Know About Fat, Fiber, and Cholesterol? A Survey of
5,116 Primary and Secondary School Students' Journal
of Nutrition Education Vol.23, No.2 pp.65-71
- Report by the Education Science and Arts Committee on
School Meals (1982) Session 1981-2, Command 8740
London: H.M.S.O.
- Report of the Commissioners appointed to inquire into the
State of Popular Education in England (1861)
(Newcastle Commission)
- Report of the Departmental Committee (1925) on the Training
of Teachers for public elementary schools
London: H.M.S.O.
- Report of the Interdepartmental Committee (1904) on
Physical Deterioration London: H.M.S.O.
- Report of the Interdepartmental Committee (1905) on Medical
Inspection and Feeding of Children attending Public
Elementary Schools London: H.M.S.O.
- Report of Working Party on Nutritional Aspects of School
Meals (1975) London: H.M.S.O.
- Richards, C. and Holford, D (eds.) (1983) The Teaching of
Primary Science; Policy and Practice Lewes, Sussex:
The Falmer Press
- Richards, C. and Holford, D. (1983), 'Approaches to
Curriculum Development' in Richards, C. and Holford, D
(eds.) The Teaching of Primary Science; Policy and
Practice Lewes, Sussex: The Falmer Press pp. 125 - 129
- Richards, C., Clayfield, R. and Lofthouse, B. (eds.) (1984),
The Study of Primary Education: A Source Book Vol.I.
London: The Falmer Press

- Robson, J.R.K., (1972) Malnutrition its Causation and Control (with special reference to protein calorie malnutrition) New York: Gordon and Breach
- Roberts, E. (1984) A Woman's Place - an oral history of working class women Oxford: Basil Blackwell
- Rolleston, H.D., (1916) Sir Gilbert Blane, M.D., F.R.S., an administrator of naval medicine and hygiene. R.Nav.Med.Serv.J. Vol.5, pp.412-19
- Rose, M.S., (1929) Feeding the Family New York: Macmillan
- Ross, D.D., (1987) 'Teaching teacher effectiveness research to students; first steps in developing a reflective approach to teaching'. Paper presented at the Annual Meeting of the Annual Meeting of the American Educational Research Association, Washington, D.C.
- Roth, K.J., Smith, E.L. and Anderson, C.W. (1983) 'Students' conceptions of photosynthesis and food for plants' Report from the Institute for Research on Teaching, Michigan State University, East Lansing, Michigan, USA.
- Rousseau, J-J. (1974) Emile in translation Foxley, B. London: Dent
- Rowell A. and Dawson C.J. (1983) 'Laboratory counterexamples and the growth of understanding in science' European Journal of Science Education Vol.5 No.2, pp.203-213
- Rowntree, B.S. (1901) Poverty, a study of Town Life London: MacMillan
- Rowntree, B.S., (1937) The Human Needs of Labour London: Longman
- Rowntree, B.S., (1942) Poverty and progress London: Longman
- Rowntree, D., (1977) Assessing Students - How Shall We Know Them? London: Harper and Row
- Royal Institution, (1940) The Nation's Larder and the Housewife's part therein Lectures at the Royal Institution of Great Britain delivered in April, May and June 1940 London: Bell and Sons
- Russell, T, Harlen, W. and Watt, D. (1989) 'Children's ideas about evaporation' International Journal of Science Education, Vol. 11, Special Issue, pp 566-576
- Russell, T. and Harlen, W. (1990) Assessing Science in the Primary Classroom - Practical Tasks London: Paul Chapman
- Russell, T. and Watt, D. (1990) Growth Primary Space Project Research Report, Liverpool: Liverpool University Press

- Scheele, C.W., (1966) Chemical Essays. London: Dawson Reprint Series
- Schilling, M., Hargreaves, L., Harlen, W., Russell, T., (1990) Assessing Science in the Primary Classroom - Written Tasks London: Paul Chapman
- Schlick, M., (1976) 'Kim: The Child - Approved Nutrition Teacher' Journal of Home Economics May pp.21-23
- Schon, D.A. (1983) The Reflective Practitioner New York: Basic Books
- Schon, D.A. (1987) Educating the Reflective Practitioner Toward a New Design for Teaching and Learning in the Professions San Francisco: Jossey-Bass
- Schools Council (1974) Approaches to nutrition education A report from a Working Party of the Schools Council Home Economics Committee London: Schools Council
- Schools Council (1977) All about me. Teachers' Guide. Schools Council Health Education Project 5-13. Walton-on-Thames, Surrey: Nelson
- Schools Council (1977) Think Well Teachers' Guide. Schools Council Health Education Project 5-13. Walton-on-Thames, Surrey: Nelson
- Schools Council (1980) Learning through Science: Formulating a School Policy London: Macdonald Education
- Schools Council/Health Education Council, (1977) Health Education 5-13 London: Forbes Publications
- Schurch, B. and Wilquin, L., (1982) Nutrition Education in Communities of the Third World: an Annotated Bibliography Lausanne: Nestle Foundation
- Secretary of State for Health (1991), The Health of the Nation A Consultative Document for Health in England London:H.M.S.O
- Secondary Science Curriculum Review (1984), Health and Science Education - proposals for action and consultation London: S.S.C.R.
- Selleck, R.J.W., (1972), English Primary Education and the Progressives 1914-39 London: Routledge and Kegan Paul
- Shannon, B., Marbach, E.S., Graves, K. and Sims, L.S. (1981), 'Nutrition Knowledge, Attitudes and Teaching Effectiveness of K-6 Teacher' Journal of Nutrition Education, Vol.13, No.4, pp.145-149
- Shannon, B. and Chen, A.N., (1988), 'A Three-year School-based Nutrition Education Study' Journal of Nutrition Education Vol. 20, NO.3 June 1988, pp.114-124

- Shardlow, D., (1977), 'Nutrition and Social Reform in the Nineteen thirties', Unpublished M.Phil thesis in History and Social Studies of Science, University of Sussex
- Shayer, M. and Wharry, D., (1974), 'Piaget in the Classroom' School Science Review Vol.55, No.192 pp. 450-458
- Shayer, M., (1976), 'Development in thinking of Middle School and early Secondary School pupils' School Science Review Vol.57, No.200, pp.568-571
- Shayer, M., (1978), 'The analysis of science curricula for Piagetian level of demand' Studies in Science Education Vol.5, pp.115-130
- Shearman, H.(1944), The New Education Act - a Citizen's Guide London: The Workers' Educational Association
- Shemesh, M. and Lazarowitz, R.,(1989), 'Pupils' reasoning concepts and their mastery of biological concepts' Journal of Biological Education Vo. 2, No.1, pp.59-63
- Simon, B., (1974), The Two Nations and the Education Structure 1780-1870 London: Lawrence and Wishart
- Simpson, M., (1984a), 'Digestion - the long grind' Aberdeen College of Education Biology Newsletter 43, May 1984, pp. 12-16
- Simpson, M., (1984b), 'Teaching about digestion and getting the system to work' Aberdeen College of Education Biology Newsletter 44, November 1984, pp.12-16
- Simpson, M. and Arnold, B. (1982a), 'The inappropriate use of subsumers in Biology learning' European Journal of Science Education Vol.4, No.2, pp. 173-182
- Simpson, M. and Arnold, B. (1982b), 'Availability of prerequisite concepts for learning biology at certificate level' Journal of Biological Education Vol.16, No.1 pp. 65-72
- Sims, L.S.,(1981), 'Further thoughts on Research Perspectives in Nutrition Education' Journal of Nutrition Education Vol.13, No.1, Supplement pp. 71-75
- Sinacore, J.S. and Harrison, G., (1971), 'The Place of Nutrition Education in the Health Education Curriculum' American Journal of Public Health Vol.61, No.11, pp.2282-2289.
- Smith, E.L. and Anderson, C.W.,(1984), 'Plants as Producers; a case study of elementary science teaching' Journal of Research in Science Teaching Vol.21, No.7, pp. 685-698

- Social Insurance and Allied Services (1942), Report by Sir William Beveridge, Command 6404 London: H.M.S.O
- Solomon, J., (1983), 'Learning about energy: how pupils think in two domains' European Journal of Science Education Vol.5, No.1, pp.49-59
- Spedding, C.R.W., (ed.) (1989), The Human Food Chain London and New York: Elsevier Press
- Spencer, D., (1982), 'School meals report turned down by DES.' Times Educational Supplement 12.11.82
- Starling, E.H., (1920), Principles of Human Physiology London: J. & A. Churchill
- Stavy, R., Eisen, Y. and Yaakobi, D., (1987), 'How students aged 13-15 understand photosynthesis' International Journal of Science Education Vol.9, No. 1, pp. 105-115
- Stenhouse, L., (1975), An Introduction to Curriculum Research and Development London: Heinemann
- Stewart, C.P. and Guthrie, D., (ed) (1953), Lind's Treatise on Scurvy Edinburgh: University Press
- Sutnik, M.N., (1981), 'The Q Sort Technique Applied to Nutrition Attitudes Investigation' Journal of Nutrition Education Vol.13, No.1, Supplement pp.103-105
- Taba, H., (1962), Curriculum development: theory and practice New York: Harcourt Brace Jovanovich
- Taylor, A.J.P., (1975), English History 1914-1945 London: Penguin Books
- Taylor, C.M. and Pye, O.F., (1966), Foundations of Nutrition London: Collier Macmillan
- Taylor, T.G., (1978), Principles of Human Nutrition Studies in Biology Series, No.84 London: Edward Arnold
- Taylor, T.G., (1982), 'What is nutrition?' Journal of Biological Education Vol.16, No.2 pp.97-99
- Thomas, A.A., (1919), The Education Act 1918 London: King and Son
- Thomas, D.P., (1969), 'Experiment versus authority: James Lind and Benjamin Rush' New England Journal of Medicine Vol.281, pp 932 -933
- Todhunter, E.N., (1976), 'Chronology of some events in the development and applications of the science of nutrition' Nutrition Review Vol. 34, pp.353-365

- Tones, K., (1981), 'Affective education and Health' in Cowley, J., David, K. and Williams, T.(eds.) Health Education in Schools London: Harper and Row pp.3-37
- Tones, K., (1987), 'Health promotion, affective education and the personal-social development of young people' in David, K. and Williams, T.(eds.) Health Education in Schools London: Harper and Row (second edition) pp. 3-44
- Tudge, C., (1985), The Food Connection: The B.B.C.Guide to Healthy Eating London: B.B.C.
- Turner, M., (1980), Nutrition and Lifestyles London: Applied Science Publishers
- Turner, M. and Gray, J.(eds.) (1982), Implementation of Dietary Guidelines - Obstacles and Opportunities B.N.F. Monograph Series London: British Nutrition Foundation
- Turner, S., (1986), 'Schools, nutrition and the wind of change' Nutrition Bulletin (BNF) Vol. 11 No.2 pp.123-131
- Turner, S., (1986), 'The Market Place' in Jennings, A.(ed.) Science in the Locality Cambridge: Cambridge University Press pp 48-60
- Turner, S., (1987), 'Teaching about nutrition in primary and secondary schools' in Rao (ed.) Food, Agriculture and Education Science and Technology Education and Future Human Needs Vol. 6, pp. 71 - 84 Oxford: Pergamon Press
- Turner, S., (1989a), 'Vitamins are good for you' Summary report based on interviews with children 1989. Department of Science Education, University of London Institute of Science Education
- Turner, S., (1989b), '"Where do carrots grow?" - ideas for teaching and learning about food and diet in schools' in Spedding A.R.(ed) The Human Food Chain London: Elsevier Press pp.143-159
- Turner, S., (1991), 'Research into children's understanding about food and diet - what are the implications for teaching?' in Coolahan, J. (ed.) Teacher Education in the Nineties: towards a New Coherence Vol.II pp.349-362 Limerick: Mary Immaculate College of Education for ATEE.
- Turner S., Dickie, N., Oliver, N., and Wiskin, P., (1988) Nutrition Workshop London: Heinz Group

Turner, S. and Frost, J., (1986), 'The contribution of school feeding programmes to science teaching in schools' in Guruge A. (ed.) School Feeding Programmes as a Potential Source of Learning Paris/New Delhi: Unesco/Unicef pp.32-39

also in Some Recent Ideas on School Feeding Digest 21 (1987) Paris: Unesco-UNICEF-WFP Co-operative Programme

Turner, S.A. and Ingle R.B., (eds.) (1985), New Developments in Nutrition Education Nutrition Education Series, No.11 Paris: Unesco

Unesco (1974) Recommendations concerning education for international understanding, co-operation and peace and education relating to human rights and fundamental freedoms Paris: Unesco

Unesco (1974) Assessment of the World Food Situation Present and Future World Food Conference, Rome 1974 Rome:FAO

Unesco (1974) Final Report of IUNS/Unesco Consultation on Nutrition Education Paris: Unesco

Unesco, (1982) Nutrition Education: Curriculum Planning and Selected Case Studies Science and Technology Education Document Series No.3 Paris: Unesco

Unesco, (1983) Nutrition Education: Case Study Experiences in Schools Nutrition Education Series No.1 Paris: Unesco

Unesco, (1983) Nutrition Education: Role of Colleges of Education Nutrition Education Series No.2 Paris: Unesco

Unesco, (1983), Primary School Curriculum Planning and Selected Case Studies Unesco Nutrition Education Series, Issue 11. Paris: Unesco.

Unesco, (1981) New Trends in Primary School Science Education (Harlen, W. ed.) Vol.1 Paris: Unesco

Unesco, (1985) Show and Tell - A Worldwide Directory of Nutrition Teaching-Learning Resources Paris: Unesco

Unit for Continuing Education (1983) District Food Policies: Issues, Problems and Opportunities University of Manchester: Department of Community Medicine

US Congress (1977) Dietary Goals for the United States (2nd.edition) Report of the Select Committee on Nutrition and Human Needs. Washington, DC: Government Printing Office

- van der Vynckt, S. and Barclay E.J. (eds) (1984) The Unesco resource pack for nutrition teaching-learning Nutrition Education Series Issue 8, Paris: Unesco
- Vygotsky, L.S. (1962) Thought and Language Massachusetts: Massachusetts Institute of Technology
- Walker, C.L. and Church, M. (1978) 'Poverty by administration: a review of supplementary benefits' Journal of Human Nutrition Vol. 32, pp. 5-18.
- Walker D., (1985) 'Writing and reflection' in Boud, D., Keogh, R. and Walker, D., (eds) Reflection: Turning experience into learning London: Kogan Page
- Wandersee, J.H. (1983) 'Students' Misconceptions about Photosynthesis: A Cross-Age Study' in Helm H. and Novak J.D. (eds.) Proceedings of the International Seminar: Misconceptions in Science and Mathematics, 20-22 June 1983, Cornell University, Ithaca, NY, USA: pp.441-446
- Warnock, M. (ed.) (1969) Utilitarianism - John Stuart Mill London: Fontana
- Waterlow, J. (1989) 'Diets of the classical period of Greece and Rome' European Journal of Clinical Nutrition Vol.43, Supplement 2, pp. 3-12
- Watson, J. and Hooper, K. (1990) Food Choice: Social and Economic Aspects of Nutrition London: ILEA
- Watt, D., (1987) 'Primary SPACE project phase one - an exploration of children's scientific ideas' Primary Science Review No.4 Summer pp. 27-28
- Watts, D.M. (1983) 'Some alternative views of energy' Physics Education Vol.18, pp. 213-217
- Webb, B., (1952) Beatrice Webb's Diaries 1912-1924 Cole, M. (ed.) with an Introduction by Lord Beveridge London: Longmans.
- Webb, B., (1956) Beatrice Webb's Diaries 1924-1932 Cole, M., (ed.), London: Longmans.
- Webb, S. and Webb, B., (1932), Methods of Social Study Cambridge: Cambridge University Press (1975 edition)
- Wellman, H.M. and Johnson, C.N. (1982) 'Children's Understanding of Food and Its Functions: A Preliminary Study of the Development of Concepts of Nutrition' Applied Developmental Psychology 3, 135-148
- Wenlock, R.W., Disselduff, M.M., Skinner, R.K and Knight, I (1986), The diets of British schoolchildren: preliminary report of a nutritional analysis of a nationwide dietary survey of British schoolchildren. London: Department of Health and Social Security

- Wheeler, E. (1985) 'Realism in Nutrition Education' in Turner, S.A. and Ingle R.B. (1985) (eds.) New Developments in Nutrition Education Nutrition Education Series, No.11 Paris: Unesco pp.22-28
- Whitehead, R. G., (1981) 'Dietary goals - past and present' Royal Society of Health Journal Vol. 101, pp. 58-62
- Wilcox, B. and Gillies, P. (1981) 'The Curricular Anatomy of Primary Health Education' British Educational Research Journal Vol.7, No.1 pp.17-25
- Wilcox, B. and Gillies, P. (1983) 'The co-ordination of secondary school health education' Educational Research Journal Vol.25, No.2 pp.98-104
- Williams, T., (1976) 'Health Education and the School Curriculum' in Health Education in Secondary Schools Schools Council Working Paper 5. London: Evans, Methuen
- Williams, T. and Roberts, J. (1985) Health Education in Schools and teacher education institutions Southampton: University of Southampton
- Williams, T., Roberts, J., Hyde, H., Wetton, N. and Moon, A., (1990) Exploring Health Education: A growth and development perspective London and Basingstoke: Macmillan
- Williams, T. Wetton, N and Moon, A. (1989a) A picture of health London: Health Education Authority
- Williams, T. Wetton, N and Moon, A. (1989b) A Way In: Five Key Areas of Health Education London: Health Education Authority
- Williams, T. Wetton, N and Moon, A. (1990) Health for Life A Teachers' Planning Guide to Health Education in the Primary School London: Nelson
- Wittrock, M.C. (1974) 'Learning as a generative process' Educational Psychology Vol.11 pp.87-95
- Wittrock, M.C. (1977) 'Learning as a generative process' in Wittrock, M.C. (ed.) Learning and Instruction Berkeley: McCutcheon
- Wittrock, M.C. (ed.), (1977) Learning and Instruction Berkeley: McCutcheon
- Wolf, R.M., (1975) A guide to the evaluation of nutrition education programs Paris: Unesco
- Woolf, L., (1964) Beginning again. An Autobiography of the Years 1911-1918, London: Hogarth Press.

- Woolf, L., (1949) 'Political Thought and the Webbs' in Cole, M. (ed.), The Webbs and their Work London: Longmans. pp.251-266
- World Health Organisation (1982) Prevention of coronary heart disease Report of a WHO Expert Committee. WHO Technical Report Series, No. 678
- World Health Organisation (1990) Diet, nutrition and prevention of chronic disease Geneva: World Health Organisation
- Young, B. and Durston, S. (1987) Primary Health Education Harlow: Longman
- Young, K., (1990) Learning through Landscapes: using school grounds as an educational resource Winchester, Hants.: Learning Through Landscapes Trust
- Young, M.F.D., (ed.) (1971) Knowledge and Control: New Directions for the Sociology of Control London: Collier-Macmillan
- Yudkin, J. (1981) 'Objectives and methods in nutrition education -let's start again' Journal of Human Nutrition Vol.35 pp.205-213
- Yudkin, J. (1986) The Penguin Encyclopaedia of Nutrition Harmondsworth, Middlesex: Penguin Books
- Yudkin, J., and McKenzie, J.C. (1964) Changing Food Habits London: MacGibbon and Kee
- Ziman, J., (1976) The Force of Knowledge; The scientific dimension of society Cambridge: Cambridge University Press

**TEACHING AND LEARNING ABOUT FOOD - A STUDY OF CURRICULUM
CHANGE IN NUTRITION EDUCATION IN PRIMARY SCHOOLS**

APPENDICES

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APPENDIX I

Curriculum Co-ordinators for primary science: course proposal and outline

Science Education Department
INSTITUTE OF EDUCATION
University of London

PROPOSAL FOR 20 DAY COURSES IN PRIMARY SCIENCE

- I Science for primary classroom teachers
- II Science for primary curriculum coordinators

Course tutors

Tim Brosnan	MA	Chemistry	MEd	PGCE
Jenny Frost	BSc Hons	Physics	PGCE	
Sheila Turner	BSc Hons	Biology	BEd	

The three tutors are established members of the science education department at the Institute. All have, in the past, taught science to A level. Mr. Brosnan has taught undergraduate chemistry courses and Mrs. Turner undergraduate biology courses. Mrs. Turner chairs the Education Committee of the Institute of Biology.

They have run initial and inservice courses in both primary and secondary science for many years. Since 1983 about 170 primary teachers have been awarded either the Institute's Diploma in Primary Science Education or the Institute's Certificate for Science Coordinators in Primary Schools. In the current year 48 teachers are enrolled on these primary science courses.

Resources

The department has a wide range of equipment appropriate to the teaching of science at both primary and secondary schools. It also has a greenhouse, a range of computers and an extensive book collection. It keeps a small number of pets in order to teach students how to care and maintain animals properly and how to use them educationally.

Field Courses

The tutors have been organising and running field courses for 15 years. These courses involve elements of biology, ecology, physics, chemistry, geology and astronomy. Field courses will form part of the proposed 20 day courses.

Fees

Course I £608
Course II £580

LEA Links

The course outlines and formats (see below) have been discussed with personnel from ILEA, two of the new inner London boroughs and two of the outer London boroughs. ILEA and the new London boroughs are in a state of flux so forward planning is difficult. It also emerged that each borough is developing different in-service and support strategies, but our proposal is flexible enough to accommodate all those suggested.

The following areas of linking and cooperation were discussed:-

- a) part of the course to be school based so that all staff become involved;
- b) part of the course to be taught by LEA personnel;
- c) participants from any one LEA forming local support groups;
- d) the local support groups contributing to inservice courses in their LEA;
- e) recruitment of participants
- f) identification of the client group

The coursework for the modules is school-based. The tutors concerned have found that on other courses with school-based assignments it is important to talk with heads of schools so that possible implications for all colleagues are understood. Meetings with heads prior to the course would be arranged.

It would be possible for part of the course to be taught locally providing the Institute were satisfied that the LEA concerned had the expertise and resources necessary. In the case of course I format 1, for instance, modules A and B and the field work could be taught by the Institute staff with the 6 other days being taught locally.

It was, however, apparent that many boroughs are buying in their INSET and would require the total course to be taught at the Institute. Bearing this in mind, Institute staff are proposing to run the whole course from the Institute, but will negotiate alternative arrangements where appropriate.

Most LEA's have tried to develop local groups from course attenders and this will be continued with help from LEA advisers. The role of these groups in local INSET will be encouraged by both advisers and Institute tutors.

Participants will be nominated by LEA advisers.

The LEA representatives at the meeting were equally divided into those that would want to send teachers on course I and those that would want to send them on Course II.

Accreditation

Both courses will incorporate two modules from the modular Diploma in Primary Science. (See Appendix 1). Course I will incorporate modules A and B; course II will incorporate module D and two half modules, C 1 and F 1. Participants will be assessed by the relevant assessment instruments (see diploma details), and successful candidates awarded the appropriate credits. Participants will, of course, have the opportunity to continue to study for the rest of the diploma in their own time later. The diploma acts as an entry qualification to the MA in Science Education.

Individual tutorial help will be available.

COURSE CONTENT

Course I SCIENCE FOR CLASSROOM TEACHERS

* Science - background knowledge in:- the nature of scientific investigation and exploration; measurement in science; types and uses of materials; the making of new materials; electronics; electric circuits; electricity and magnetism; sound and music; the earth in space; forces; the variety of life; simple ecology related to three specific habitats; genetics and evolution; introduction to geology. (See note on page 3 about the depth of treatment).

*The design of learning activities in science for children 5 - 11 years;

*Teaching and learning strategies for science;

*Resources for teaching science;

*Formative assessment strategies.

Course II SCIENCE FOR PRIMARY CURRICULUM COORDINATORS

* Science - background knowledge in: processes of life; energy in living systems; energy and power in physical systems; light and colour; light and seeing; the earth in space; forces; the variety of life; simple ecology related to three specific habitats; genetics and evolution; introduction to geology. (There may be a need to include electronics also in this course). (See note on page 3 about the depth of treatment of science topics).

*Use of assessment strategies for formative and summative assessment and for curriculum evaluation.

*Strategies for supporting colleagues, particularly with respect to science background;

*Development of whole school policies for science;

*Continuity and progression in science concepts;

*Management and development of whole school resources.

COURSE STRUCTURES and LENGTH of PROVISION

Each course will be offered in two formats:

Format 1: One evening a week for two terms, when participants attend diploma classes, (20 sessions altogether). On 12 of these occasions the evening session will be preceded by an afternoon session, when much of the science content will be taught. This will be augmented with a block of 6 days in the summer term, four of which days will be spent on a field trip. The classroom teachers' course will have an additional weekend course at the start. (See figure 1). This format will require supply cover for a total of 10 whole days.

A variation on this model is to put the 12 x 1/2 days into two blocks of 3 days each. The 12 1/2 days have been labelled "supporting science" as there will be used to cover the science areas which are not covered in the diploma modules, but are required areas of the 20 days DES courses.

Format 2: This will take place entirely during school time and therefore requires 20 days supply cover.

Course I has 16 consecutive days in the Autumn term and followed by the Summer field course.

Course II uses Thursdays and Fridays for 8 weeks in the Spring Term followed by the Summer field course. (See figure 1). Tutors are still considering the possibility of altering the 8 Thursdays to a single 8 day block.

Both formats will be offered each year, hence providing for 2 cohorts of classroom teachers and 2 cohorts of coordinators.

15 participants can be accommodated on format 1

20 participants can be accommodated on format 2.

DEPTH OF COVERAGE OF SCIENCE

Course I focuses on teaching and assessment strategies. We have found in the past that considerable scientific understanding comes from these contexts because they require teachers to clarify the necessary concepts and skills that children are to learn. The topics specifically mentioned in the diploma course will be studied in this way. In addition the coursework requires teachers to implement these strategies in the classroom and write up evaluative reports.

The summer field trip allows for teaching of variety of life, introduction to geology and the earth in space. There are opportunities for night time observation of star moon and planet movement. Students also undertake practical

problem solving of the 'design and make' type. For instance this year students were set the problem of taking aerial photographs from a kite, a task that involved the consideration of forces required to lift the weight of the camera and to trigger the camera mechanism.

The topics of 'making of new materials' and 'the constitution of matter' do not feature in the national curriculum for primary schools. The teaching of this will therefore be done to provide adequate background to enable teachers to be aware of the way in which the subject will develop as pupils progress into the secondary school. These topics will cover the concept of chemical change, underpinned with a small number of examples.

Most of the traditional formal work on evolution and genetics does not appear until level 5 of the National Curriculum. What occurs in level 1-4 might be described as 'variety of living things'. The study of evolution and genetics on the 20 day courses will make teachers aware of the theories used to explain the variety of life, and to understand current popular literature on genetic engineering.

In the short time available the work in electronics will aim to remove some of the mysticism often associated with this subject. Levels 4 and 5 of AT12 seem to be causing concern. The use of simple logic circuits will be taught using the MFA circuits. In addition participants will make one small gadget from component parts. The concept of control will be taught through other topics, not just electronics.

Much of the above applies to course II. The topics chosen for consideration in module D are all covered in research literature on children's alternative frameworks. Much of this literature will form the background reading for the course and we have found in the past that consideration of children's ideas on these topics enables teachers to clarify their own ideas.

It is difficult to define a precise level of understanding that we hope to achieve in all this because it will vary from person to person. We have however attached a copy of the science examinations which have been used in past years as part of the assessment of the diploma. Such an end-of-course examination will no longer feature in the new modular diploma but individual questions will be set as part of the required coursework in modules A and D. Participants will have to reach an appropriate standard in these to gain the respective credits.

CRITERIA FOR SUBMISSIONS

Under this heading, the DES asks providing institutions to answer a range of questions. Some issues raised by these questions have been considered in the earlier part of this submission; the rest are discussed below.

Teaching approaches:

A wide range of teaching strategies will be used, including lectures, workshops, discussions and private study. On many occasions participants will take the lead in order to develop their skills of teaching adults.

Training for monitoring progress

Module B provides specific training in assessment, starting from assessing an individual child to assessing a whole class. This module does not occur in the coordinators' course. Module D, however, is included in the coordinators' course and requires participants to use and evaluate assessment techniques.

Training for the role of coordinator

It is impossible to do this job as thoroughly in 20 day courses as in the 35 days course currently running at the Institute. There are however a number of strategies we shall use, e.g. i) at the start participants will be given both a job description for post of coordinator and an account of 'one year in the life of a coordinator'; these will be discussed in order to 'tune the group' into their new role. ii) cross reference to this role will be made in most other sessions iii) the half module F, and its coursework is designed for this iv) participants will be encouraged to make notes on the structure of sessions, not just the content; v) see "Teaching approaches" above.

Responding to individual needs

Participants will be required to write a brief summary of their 'hopes and expectations of the course'. Tutors have used this on all previous courses; it has provided a useful insight into the range of needs of the group. In 20 days it is unlikely that all needs will be met, but it will be possible to make explicit what can and cannot be achieved.

The school-based coursework caters for individual needs. There is room for some negotiation in the focus of coursework. Private study will also help cater for different needs.

People with different needs and experience always take different things away from any learning experience.

Preventing fragmentation; ensuring continuity and progression

All the diploma modules have been planned to give coherence within modules and between modules. But the most powerful strategy is the insistence on written coursework because the act of writing forces an individual to clarify thoughts and present a coherent whole. Both analysis and synthesis are required in the assignments.

For further information and clarification, please contact:

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20 Bedford Way
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File:Dips-Proposal

APPENDIX II

**Participants expectations of the course - pre-course
questionnaire**

APPENDIX II

24.1 PRIMARY SCIENCE FOR CURRICULUM COORDINATORS
DES 20 DAY COURSE 1990/91

PRE-COURSE QUESTIONNAIRE

1. What skills do you hope to develop during the course ?

2. What knowledge do you hope to acquire?

3. What attitudes do you expect to be examined during the course?

4. On the list below please indicate what percentage of your learning you expect to come from different sources

	Percentage
tutors
outside lecturers
fellow students
reading primary science books
reading educational research
individual study
classroom experience
other (please specify)

5. Are there any aspects of the course which you are worried about or any questions that you want to ask about the course?

APPENDIX III

Summary of responses to pre-course questionnaire

APPENDIX III

SCIENCE COORDINATORS FOR PRIMARY SCHOOLS 1988-89

SUMMARY OF RESPONSES TO PRE-COURSE QUESTIONNAIRE

1. What skills do you hope to develop during the course ?

The skills mentioned could be divided into four groups - most people mentioned all four :-

a) those at your own level e.g. the development of practical skills such as using a microscope, model building, making observations, asking scientific questions, devising experiments and investigations using simple apparatus,

b) teaching skills - helping children to learn science, identifying the needs of individual children, planning for science, developing/extending familiar activities such as close observation or asking questions to help children to be more observant/aware and to introduce children to "wonder about the world", planning and extending work in science, developing and sustaining children's interest, identifying science in non scientific topic areas

c) assessment and evaluation - most people mentioned this in relation to the assessment of children's work and monitoring progress, including skill development. One person also included self assessment of teaching practice.

d) "expertise as a Coordinator", particularly organisation and management, chairing meetings, running INSET, supporting (and influencing) staff - "communicating in a meaningful way with colleagues", "passing on what I have learnt", encouraging science/investigations in school - liaison inside and outside school, developing resources for science,

2. What knowledge do you hope to acquire?

It was possible to group the responses into those that were related to personal gains in knowledge and understanding about science, those that related to knowledge about teaching science and assessment - the National Curriculum featured in five responses - and those that focussed on issues such as organisation and resources.

a) Three quarters of you mentioned updating and extending your own knowledge of science particularly physical science, including electricity, and technology,

b) Knowledge of primary science was mentioned by half of you, some people also mentioned increasing their knowledge of the ways in which children learn and teaching strategies. The National Curriculum and the

justification for teaching science ("to help staff identify what is meant by science"), assessment and recording in useful ways were also considered important.

c) Organisation for science including resource management plus knowledge of useful resources such as equipment, books - including reference books for staff - visits. Staff development, "starting science in a school where none exists", developing a science policy were all mentioned (one of the Diploma students also included "ways of sustaining interest and enthusiasm in staff")

3. What attitudes do you expect to be examined during the course?

Personal, staff and children's attitudes were mentioned - eight people included attitudes to science e.g. enthusiasm, and others personal attributes e.g. open-mindedness, perseverance, awareness of and to the needs of staff and children - which included developing the ability "to guide without telling" - interactions with children.

Some of you mentioned attitudes to children, colleagues, parents and to study.

(One of the Diploma students mentioned "positive attitudes towards science as part of the whole curriculum"; another attitudes to knowledge and understanding in science)

4. This question asked you to indicate what percentage of your learning you expected to come from different sources.

The range of expectations plus the average is listed below:

tutors	10 - 80	35%
outside lecturers	0 - 60	10%
fellow students	0 - 60	25%
reading pr.sc. books	0 - 60	25%
reading educ. research	0 - 60	18%
individual study	10 - 80	30%
classroom experience	20 - 80	40%

other - two people mentioned liaison and interaction with other people e.g. school staff, science advisers, support teachers.

Some of you found it difficult to allocate percentages to the different items listed and allocated equal amounts of time e.g. 60% to a number of things which you considered equally important so that the total came to over 100%. However the balance between the different sources indicated by the average expectations is perhaps realistic. We hope that those of you who did not appear to expect to learn much from fellow students or books will revise your expectations as the course proceeds.

APPENDIX IV

'Vitamins are good for you'

"VITAMINS ARE GOOD FOR YOU"

SUMMARY OF FINDINGS FROM INTERVIEWS AUTUMN 1988

This report summarises some of the important outcomes and issues which you have identified in your reports based on your interviews with children related to food and diet. In analysing the findings from your research I have divided the learning outcomes into five categories:-

1. children's knowledge and understanding about food and diet,
2. children's general scientific knowledge and understanding and skills,
3. teacher knowledge and understanding concerning food and diet,
4. implications for teaching,
5. the teacher as researcher.

I should value your comments on what I have written about these outcomes.

1. Children's knowledge about food and diet

The main focus of your reports was the interviews with children and your findings. The reports also contained an analysis of your results in which the most important feature related to children's understanding. The discussion of the children's knowledge and understanding can be separated into that which deals with knowledge and understanding which is related specifically to food and diet and that which covers more general areas allied to skills, which is looked at later (Section ii).

For the purposes of this discussion children's knowledge about food and diet has been sub-divided into three sections. The first summarises the findings from the activities you undertook. The second considers children's knowledge and understanding which accords with the 'scientific' view. The third section is concerned with examples of children's conceptions about food and diet, where their understanding is at variance with accepted views about food and diet; these ideas were identified as alternative frameworks.

1.1 Summary of results from interviews

1.1.1 Food groups

The majority of children, of all ages, use a mixture of food groupings which includes some form of food classification allied to a system where associated foods e.g. fish and chips, bread and cheese, are grouped together. The foods most commonly classified are fruit and vegetables, followed by sweets. Few pupils use a meal grouping system although many foods grouped in pairs e.g. chicken and rice, could be interpreted as what is eaten together as part of a meal. Pupils below the age of eight are most likely to use groupings such as like/dislike, colour, shape, taste, texture. Dairy groupings were only used by pupils aged 9 years or above.

1.1.2 Food choice

Some of you expressed disappointment that your pupils' food choices for meals were so sensible and ordinary! Cereal and/or bread (often as toast) was the breakfast chosen by 49/50 children. The majority of the children made choices based on the pictures, or their interpretations of the pictures, few children (these were normally children older than nine years) extended the foods chosen to other food items e.g. samosas or pizzas. In the majority of cases children chose the foods they did because they were the foods normally eaten at home and/or because they were liked or favourite foods. A minority cited health reasons for their choices.

The comments on snacks were revealing e.g. "What I am allowed", "I eat these on the way to school", "If you had too much you wouldn't eat your dinner." A sample of the foods chosen for snacks is shown in the attached table. Crisps and coke/cola headed the list (over 50% of responses for children over 7 years). Sweets were also mentioned by a large number of children but fruit was mentioned just as frequently.

1.1.3 Knowledge of nutrients

All the children had heard of sugar, all but two had heard of fat and salt, four children did not recognise the word vitamin (two of these children were ESL).

About half of the children could give a reasonable working definition of sugar, fat and salt e.g. salt = small crystals, fat = part of meat. The idea of vitamins as tablets was widespread. Vitamins were equated with health or as being good for you whereas sugar and fat were bad for you.

Fibre, protein and minerals were recognised by just over half the children, many of these children could give examples of these nutrients although few could say what they were. Fibre was normally recognised as being good for you.

Starch and carbohydrates were recognised only by a small proportion of children, normally aged seven or older; some could give examples, none could explain

adequately what these nutrients were.

1.1.4 Why do we eat food?

The responses given fell into three categories -

- a. positive reasons e.g. to keep us alive
- b. negative reasons e.g. "If we didn't eat we would die"
- c. mixed response which included positive and negative reasons

I am still working on the data for this section; it appears that the numbers of children giving positive and negative responses is roughly equal, with a small minority from all age groups giving a mixed response. Children above the age of nine give negative responses more frequently than younger children.

1.2 Knowledge about food and diet

All of you recognised the importance of establishing and utilising the prior knowledge that children possessed. Many of you commented, occasionally with surprise, at how much children understood about what they ate and why they ate particular foods. The knowledge that children had was generally considered in relation to home background rather than that gained in school; many younger children in explaining why they ate particular foods stated that it was eaten because their parents said it was good for them. Your comments could be grouped into those which dealt with aspects of food and health and those which related to variety and balance.

1.2.1 Food and health

The findings indicate that even five and six year olds have considerable knowledge of food and diet. Some six year olds appear to understand that specific nutrients, notably fats and sugar, are related to health as is revealed in the following transcribed conversation with a six year old girl who is unable to explain why we eat sugar:-

T. "Do you know why we eat sugar?"

E. "BecauseIt's not good for you."

E. "It's not very good at your teeth."

Older children are able to articulate their ideas more clearly, for example C (9 years) talking about sweet things says "we should only eat these in small quantities."

1.2.2 Variety and balance

The children's recognition of the need for variety and balance in the diet was commented on by some of you.

"They (6 year olds) also seem to have appreciated the need for variety in the diet, as this is reflected in their meal choices."

The idea of 'balance' was remarked upon in the context of comments by individual children for example :-
C. (aged 9) talking about choosing supper said "I need protein, vegetable and fibre. I like all these."

1.3 Alternative frameworks

The range of ideas held by children was discussed by all of you. You related the children's ideas both to your own experience and the work of others, in particular that reported by Osborne and Freyberg (Osborne and Freyberg, 1985).

The discussions on occasions included examination of ideas relating to the properties of foods, such as taste, as well as those linked to specific nutrients, for example, M. (6 yrs) reveals that her concept of 'sweet' is not that of her teacher:-

"During a tasting experiment M. may have described a certain food as being sweet. Because she would be using an acceptable term I would have assumed that she meant something tasted sugary. However as a result of the interviews I know that she may not mean that at all."

The idea of 'sweet' things including crisps was common to all age groups and is probably linked to the concept of 'nice tasting'. Sweets are 'nice' therefore other foods also considered as nice, or favourite foods, such as crisps tended to be categorised as sweet.

Other ideas commented upon included :-

The widespread notion that vitamins are tablets/pills. Confused ideas about protein e.g. "these give us our energy" - boy 9 years
Where the word carbohydrate was recognised it was often linked to "a gas" (girl 9 years). The word was probably being confused with the term carbon dioxide which children had heard in connection with gases in the air or respiration. It was also confused with dehydration.

2. Skills and understanding

All of you included discussion of skills and understanding which were applicable to the whole of science and health education as well as food and diet. I have subdivided your comments into two groups, those relating to classification and those which relate to identifying similarities and differences:-

2.1 Classification

Sorting objects into groups is a common activity at all stages of primary education, particularly in mathematics. The majority of you, including those working with infant classes, indicated that when you began Activity 1 you felt confident that pupils would have no difficulty in placing the pictures of foods into groups as a result of their earlier experience of grouping objects into sets. In many instances Activity 1 revealed that even some eleven year olds found this grouping activity difficult, not because they were confused by the cards themselves, or the number of cards involved, but because of their inability to transfer the skills they had gained elsewhere to this new situation. Younger pupils were more likely to be hampered. One of you, commenting about a six year old, wrote :-

"Her sorting experience (i.e. prior experience) must be limited to sorting into groups which are the same rather than into groups whose elements are different but have a common link."

A way of overcoming this difficulty was suggested:-
"We could make a collection of all the items they have grouped as vegetable or fruit and compare the items in each group. How are they different or similar?"

Some of you recognised that when you studied pupils' groupings in more detail what appeared to be confusions could be interpreted as a common sense view of foods which could be eaten together.

2.2 Identifying similarities and differences

The difficulties of grouping and the importance of giving children opportunities to look for similarities, as well as differences, were highlighted by many of you.

"The children (8-9 years) seemed to realise that some foods could fit into several groups and the group they finally selected was not always the most useful...
"The children at their stage of development found it difficult to decide exactly which were the important similarities e.g. P's chicken would have been more appropriate in the "cooked group" than in the "grocery group" which was otherwise all fruit and vegetables."

3. Teacher knowledge

Many of you in discussing the interviews with your pupils indicated that you yourselves had learnt more about food and diet as a result of undertaking the activity. Although you rarely included details of what you had learnt in your written reports the group discussions, both prior to and

after the interviews, led to individuals raising questions that they themselves wanted answered about food. The questions related to the knowledge implicit in all four activities which you undertook with pupils i.e. meal choice, nutrients and their function in the body, dietary patterns and health.

Comments such as :-

"In doing the tests I realised how much I didn't know about food!"

"I realised how limited my knowledge of food was, together with what we need and why."

were common; you recognised that the very nature of the activity had caused you to review your own ideas and understanding about aspects of food and diet. Some of you indicated that you now had greater awareness of what was meant by 'healthy eating' including linking excess/lack of nutrients to specific health disorders.

Some of you expressed surprise at the level of children's awareness of health and diet in relation to your own:-

"I also discovered that my own choices of food for meals would not, subject to similar analysis, produce very different comments from the children's."

This remark is significant. It reflects our common experience and can be linked to the constraints, including the social, economic, cultural factors, which influence our choice of food in the same way as the children we teach.

Many of you still have questions which you want to ask about food. Some relate directly to the work undertaken with the children, for example:-

"Do we need fat in the diet? How much do we need?"

"Why do we need to eat salt?"

"What is 'organic' food?"

"Are additives harmful?"

Some questions relate to issues which are currently being debated in the media:-

"Do egg whites contain salmonella?"

"What food is not safe to eat?"

"What is the link between cholesterol in the blood and consumption of fatty foods?"

Other questions are of a more general nature:-

"What is the effect of advertising in promoting particular foods?"

"Are microwaves safe to use?"

These questions are ones which we need to address in the future.

There were probably a number of reasons why so few of you included discussion of your own knowledge and understanding about food in your reports: the type of report or our notes of guidance may have acted as a constraint; its focus on

children's learning may have caused you to consider your own learning as less relevant; you may have felt that you had not learnt anything!

4. Implications for teaching

You all included some discussion in your reports about the implications for teaching of your findings. Most of you indicated that the results had implications for all your teaching, not just food based topics. Many of you reported that you had found the activity of finding out what children understood particularly helpful and would use the strategy as a starting point for teaching about food in the future. Points commented upon included:-

4.1 The importance of really listening to what pupils say:-

"It is important to listen to the children's answers even if they were not what you were expecting."

4.2 The range of development even within the small sample of children interviewed from each class.

"...the range of scientific development was greater than I anticipated."

A very significant outcome for many of you was that children did not always perform according to expectation.

"I had expected K., a very articulate and confident boy who always performs well during problem solving activities to possibly be as good as C.. However without doubt C's ideas of food and diet far exceeded those of K and Ch."

4.3 Observing one child is a means of developing the skills needed for observing larger groups in a class. Such skills will be of increasing importance in the context of assessment in the National Curriculum in England and Wales.

4.4 The need for continuity and progression is widely recognised however there are concerns that neither are being achieved. If progression is to be achieved it is important to build on the knowledge that children already have in a planned way.

"While each teacher may cover the part of this topic (food) there needs to be more continuity and discussion on how the staff in school see a progression from reception to top junior."

4.5 The importance of discussion in learning, both discussion between pupils and between teacher and pupil, was acknowledged:-

"Children need opportunities to discuss ideas and findings."

4.6 The choice of suitable activities, of a type identified by one person as **meaningful activities**. When teaching about food, particularly with younger children, it was important to:-

"concentrate on ideas that they can experience, for example, grouping of foods."

4.7 The need to change direction to accommodate children's interests and develop their thinking was commented on by some people:-

"You must be prepared to alter your tack to pursue some of the children's ideas."

Only a small proportion of you taught a food related topic in the term following the interviews. Some of you reported on how you had extended the task or planned to utilise the findings from your interviews in subsequent work on food. A few of you included a topic plan which indicated how you would teach the topic in future. One person asked the children in his class to bring in pictures of food, from newspapers and magazines, prior to interviewing.

"I wanted them to appreciate the rich diversity in the foods that we eat The proposal (to bring in pictures) gave rise to a critical discussion about the nature of food and what counts as food:-

'Can we bring in a picture of a Mars bar, Sir?'

'He can't sir because that's a sweet, isn't it?'

'But we eat it sir, so it must be a food' ...

This initial discussion revealed much about the understandings and misunderstandings in the class. The following day members of the class brought in not just pictures but examples of different food, including sugar cane, which became the starting point for more detailed work than he had initially planned.

5. The teacher as researcher

Many of you commented on the difficulty you experienced in acting as a researcher; some of you wanted to extend the activity so that it became a "teaching situation".

"I found it very difficult to transfer from being their class teacher to the role of tester because I know the children so well and associate with their feelings."

"I felt unsure as to what extent to intervene and I feel that I did not always ask enough questions."

The use of the tape recorder during the interviews was found helpful in ways other than just revealing what was actually said by children.

" I have realised that if the responses given by the children were acceptable to my own ideas and understanding, then I did not question further."

Such findings have evident implications for teaching.

Two of you pointed out difficulties in learning what children think even in this type of interview where children are not expected to give "correct" answers. Some of you identified the nonverbal clues that you were giving.

Most of you appreciated how important is that ability to listen to what children actually say. This skill was being developed during the interviews and it has important implications for your teaching, including the assessment of pupils.

It is evident that the ideas from the Learning in Science Project (LISP) (Osborne and Freyberg, 1985) have been particularly helpful in helping you to appreciate the strength of children's ideas and the resistance of these to change through teaching.

Finally, you have been engaged as an active participant in a research project. Do you think that you have gained more understanding of the nature of educational research as a result? It is possible that this activity, including the opportunity which it has given you to reflect on your practice in the classroom, may help you to identify and to recognise the implications of research findings for your own teaching practice.

Sheila Turner
May 1st 1989

APPENDIX V

**Notes of guidance for students on interviews: Trial
interviews 1987 to 1988**

APPENDIX V



University of London Institute of Education

20 Bedford Way, London WC1H 0AL Telephone 01-636 1500

Director: Professor Denis Lawton, BA, PhD

Science Education

Professor of Science Education and Chairperson: Jon Ogborn

Research into Children's Ideas About Food and Food Groupings

The purpose of this research is to investigate children's ideas about aspects of food and diet. For the pilot study it is proposed to interview children in small groups or individually. Three activities have been designed for the study each of which takes approximately ten minutes.

If you feel able to participate in this research, either by conducting interviews or by allowing me to talk with some of the children in your class, please could you let me know?

If you are planning to teach a topic on food, I should be particularly interested in talking with groups before the topic begins and after it is completed.

Thank you for your help.

A handwritten signature in cursive script that reads "Sheila".

Sheila Turner

Research into children's ideas about food and diet.

Pilot Study December 1987

Activities

The three activities outlined below could be carried out with individual children or small groups of not more than four children. They could be run at different times. It is very important to stress that the children are not being 'tested'.

Activity 1 - Grouping Food

Children are generally aware that foods are placed in groups. For example in shops/supermarkets or in the home. The intention of this activity is to investigate the sorts of groupings which pupils use. The simple drawings of thirty foods shown overleaf can be cut up for children to use in this activity.

The children are given the pictures and asked to sort them into groups. The groups chosen are noted on the report sheet. Numbers have been assigned to each picture so that the items placed in each group can be noted more easily on the recording sheet. Any items which children are not sure about can be placed in the 'not sure' group.

Activity 2 - Meal Choices

Children are asked to use the pictures to plan what they would choose to eat for breakfast, lunch, tea/supper plus snacks. They may use any picture more than once - for example oranges might be used for breakfast and supper. The items chosen are noted on the report sheet. Space has been left on this report sheet for reasons children give for their choices.

Activity 3 - Ideas About Nutrients

In this activity children's understanding of nutrients is explored using 'flash cards' with the names of nutrients as shown on the attached sheet. A suggested questioning procedure is outlined below:-

1. Can you tell me if you have seen (or heard) this word before?

[If the response is negative the cards are put to one side and questions 2 and 3 omitted]

2. Can you tell me what you think.....is?

[Note - children may give examples of foods instead of a definition]

3. Can you tell me the names of any foods which you think have in them?

[The pictures used in activities 1 and 2 can be used here].

The order in which the cards are used is not important. It has been found helpful to start with any words, such as fat, which the children have used spontaneously in previous discussion. It is important to stress that it does not matter if the children have not heard the word before or if they cannot say what the word means.

Activity 4 - Why Do We Need Food?

At some point during or after activities 1-3, please could you pose the question:-

Could you tell me why you think we need food?

Recording Space has been left on the recording sheets for comments made by the children which you find particularly interesting. You may also want to comment on the activities themselves. I should very much appreciate suggestions for ways in which the activities could be modified or improved or the record sheet made easier to use.

APPENDIX VI

Report forms for interviews with children 1987 to 1988

Research into Children's Ideas About Food

Record Sheet

1. Age of child yrs. mths.
2. Sex of child girl/boy Please delete as necessary
3. Other relevant information
(e.g. ESL, statemented).

Background knowledge

4. Has the child been taught a topic which includes food in the past 6 months? Yes/No
5. If the answer to 4 is yes, please could you give brief details, e.g. theme of topic and when it was taught.

Topic:-

Taught:-

6. Activity 1 - Grouping Foods

Groups	Fruit	Veg.	Meat	Fish	Sweet Things	Other.. Not sure
--------	-------	------	------	------	--------------	---------------------

Food
Items
Included

Comments

7. Activity 2 - Meal Choices

Foods Chosen

Reasons for Choice

Breakfast

Lunch

Tea/Supper

Snacks

Comments

8. Activity 3 - Ideas About Nutrients

Nutrient	Word Recognised	Definition	Examples
----------	-----------------	------------	----------

Sugar

Starch

Fibre

Vitamins

Minerals

Protein

Carbohydrate

Fat

Comments

9. Why do we need food?

Response:

File:Dip.Prim.Sci-res.

APPENDIX VII

Notes of guidance for interviews with children 1988 to 1991

Research into children's ideas about food and diet.

Activities

The purpose of the activities is to discover what children know about why we eat food and their understanding about food and diet.

The three activities outlined below should be carried out with individual children. It is very important to stress that the children are not being 'tested' and the first activity is designed to be 'fun': with infants it may be a good idea to begin by letting the children handle the cards to see whether they recognise all the foods. Any cards with pictures of foods which are not recognised can be placed on one side.

Although we have suggested that you tape record the children, you may also find it helpful to use a simple record sheet like the one on pages 3 and 4.

Activity 1 - Grouping Food

Children are generally aware that foods are placed in groups. For example in shops/supermarkets or in the home. The intention of this activity is to investigate the sorts of groupings which pupils use. The simple drawings of thirty foods attached can be cut up for children to use in this activity or you may want to make your own cards. The foods have been chosen to illustrate a range of different foods; previous investigations have indicated that thirty cards are the maximum that children can cope with easily.

The children are given the pictures and asked to sort them into groups. The groups chosen are noted on the report sheet. Numbers have been assigned to each picture so that the items placed in each group can be noted more easily on the recording sheet. Any items which children are not sure about can be placed in a 'not sure' miscellaneous group.

Activity 2 - Meal Choices

Children are asked to use the pictures to plan what they would choose to eat for breakfast, lunch, tea/supper plus snacks. They may use any picture more than once - for example oranges might be used for breakfast and supper. The items chosen are noted on the report sheet. Space has been left on this report sheet for reasons children give for their choices - they often give reasons when selecting items and these provide insights into why particular choices are made.

Activity 3 - Ideas About Nutrients

In this activity children's understanding of nutrients is explored using 'flash cards' with the names of nutrients as shown on the attached sheet. A suggested questioning procedure is outlined below:-

1. Can you tell me if you have seen (or heard) this word before?

[If the response is negative the cards are put to one side and questions 2 and 3 omitted]

2. Can you tell me what you think.....is?

[Note - children may give examples of foods instead of a definition]

3. Can you tell me the names of any foods which you think have in them?

[The pictures used in activities 1 and 2 can be used here].

4. Can you tell me why you think we need to eat e.g. vitamins?

The order in which the cards are used is not important. It has been found helpful to start with any words, such as fat, which the children have used spontaneously in previous discussion. It is important to stress that it does not matter if the children have not heard the word before or if they cannot say what the word means.

Activity 4 - Why Do We Need Food?

At some point during or after activities 1-3, please could you pose the question:-

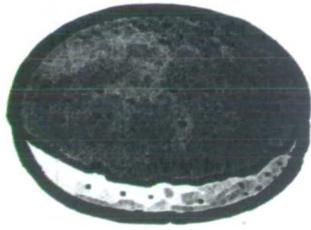
Could you tell me why you think we need to eat food?

Recording Space has been left on the recording sheets for comments made by the children which you find particularly interesting and for you to comment on the activities themselves.

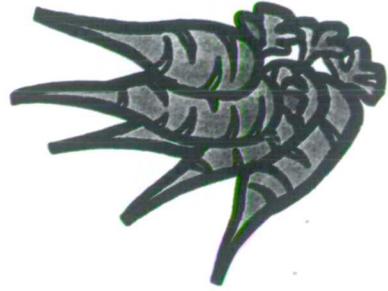
Key to pictures of foods used in food grouping and food choice activities

1	roll/bun	2	carrots
3	strawberries	4	beans
5	cake	6	fish
7	margarine	8	sweets
9	cola	10	potato
11	lettuce/cabbage	12	egg
13	biscuit	14	crisps
15	tomato	16	cheese
17	chips	18	jam
19	orange	20	oil/sauce
21	nut	22	jelly
23	icecream	24	cereal
25	milk	26	chicken
27	corn on the cob	28	rice
29	banana	30	bread

1



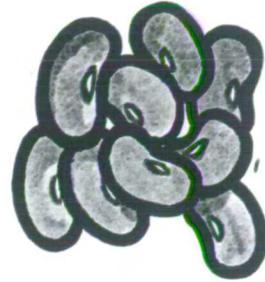
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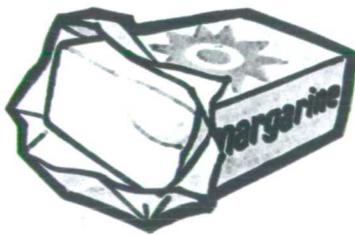
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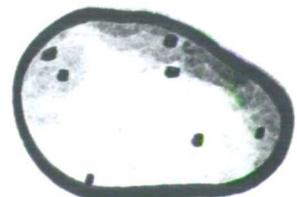
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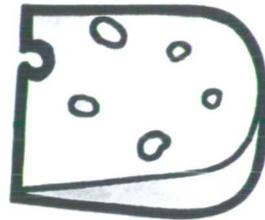
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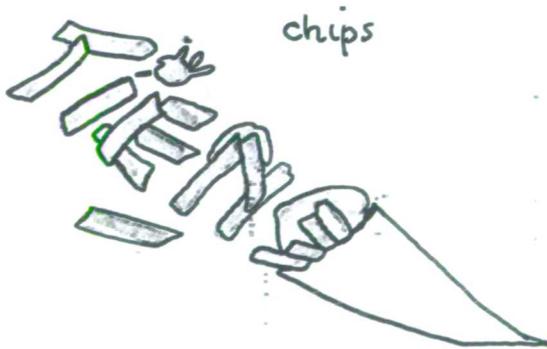
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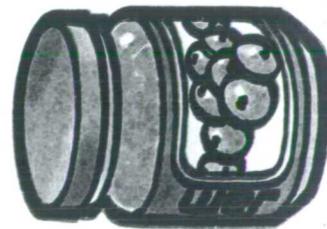
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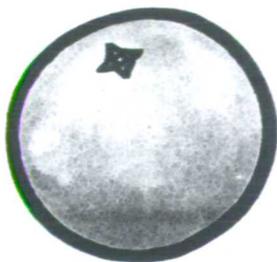
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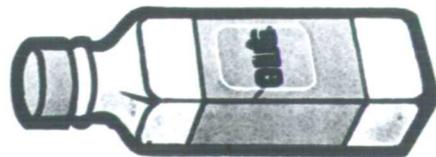
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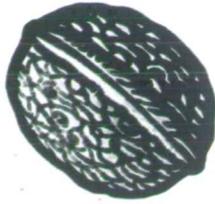
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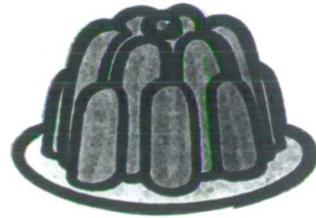
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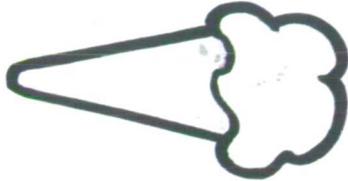
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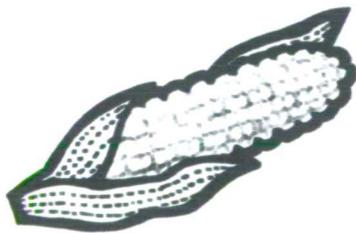
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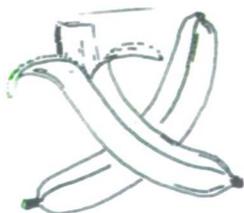


28

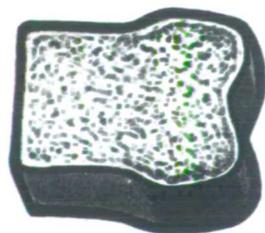


rice

29



30



carbohydrate

fat fibre

minerals

protein salt

starch sugar

vitamins

APPENDIX VIII

Report forms for interviews with children 1988 to 1991

Research into Children's Ideas About Food

Record Sheet

1. Age of child yrs. mths.
2. Sex of child girl/boy Please delete as necessary
3. Other relevant information
(e.g. ESL, statemented).

Background knowledge

4. Has the child been taught a topic which includes food in the past 6 months? Yes/No
5. If the answer to 4 is yes, please could you give brief details, e.g. theme of topic and when it was taught.

Topic:-

Taught:-

6. Activity 1 - Grouping Foods

GROUPS

Food Items Included								

Comments

7. Activity 2 - Meal Choices

	Foods Chosen	Reasons for Choice
Breakfast		
Lunch		
Tea/Supper		
Snacks		

Comments

8. Activity 3 - Ideas About Nutrients

Nutrient	Word Recognised	Definition/ explanation	Reasons for Eating	Examples
Sugar				
Starch				
Fibre				
Vitamins				
Minerals				
Protein				
Carbohydrate				
Fat				
Salt				

Comments

9. Why do we need food?

Response:

File:Dip.Prim.Sci-res.

APPENDIX IX

Food and health: pre-interview questionnaire

APPENDIX X

**Summary of participants' responses to questionnaire
about food and health January 1990**

APPENDIX X

DIPLOMA IN PRIMARY SCIENCE - Module B

January 1990

RESPONSES TO QUESTIONNAIRE ABOUT FOOD

Q 1 What do you understand by the word 'food'?

There were two types of responses:-

- a. "Food is anything that I eat"
- b. Requirement for life -
"Something that living organisms need in order to sustain life"
"Anything that provides the body with one or more of the basic requirements for life" - nutrients such as vitamins, proteins, fats were mentioned in this context.
Two people mentioned food as a source of energy and its importance in growth.

Q 2 Why do we need food?

The responses can be grouped into two:-

- a. Requirement for life - Food "provides us with the nourishment needed to sustain life."
For maintenance and repair of body tissues. Health.
- b. Food as an energy source - we need food as "fuel to keep us warm, give us energy."

Q 3 What do you understand by a 'healthy diet'?

Everyone used the word 'balance' in answering this question, in many cases in the context of specific nutrients:-

- "A well balanced diet which provides neither too much nor too little in the way of vitamins, carbohydrates, proteins ..."
- "Balanced selection of nutrients ... to give us the appropriate amount of energy..."

Some people talked about amounts of particular types of foods:-

- "Lots of vegetables, fruit ..."
- "Not too many fats or sugar."
- "Unrefined foods where possible, polyunsaturated oils in preference to saturated fats and oils."

The following comments provide us with starting points for discussion:-

"My sources are T.V. advertising and vague common sense assumptions about food i.e. that a particular balance of vitamins is essential for a healthy body. Health is a moot point, what does it mean?"

"One is constantly reading contradictory advice. People in the West are over obsessed by the subject I think."

Q 4 Factors governing food choices - a range of factors was mentioned the most frequent being:-

Personal preference - what is liked and enjoyed
Price/income

Other factors mentioned:-

Whether food is healthy/unhealthy - allergies and diabetes - additives
Taste including texture; appearance/presentation; freshness
Availability - including shops open locally
Time of day; speed and ease of preparation - convenience
Habit
Place and occasion
Culture and religion
Interest - new and foreign foods

** Missing from the list above - hunger and appetite!
- media and advertising

Q 5 Food groups - what system do you use?

Two main grouping systems were used:-

- i. Nutrient groupings e.g. proteins, fats, carbohydrates
- ii. Food based systems e.g. meat/fish; dairy; vegetables, fruit; cereals.

(Other groups have pointed out that their groupings would change according to context e.g. cook, teacher or dieter)

Q 6 Questions about food and diet - these fell into three categories:-

- i. Those related to nutrients and food constituents e.g.
 - which foods contain particular nutrients?
 - how many kilojoules (calories) do particular foods contain?

- ii. Food and health e.g.
 - what foods should be eaten/avoided by particular individuals e.g migraine sufferers, diabetics, arthritics, asthmatics, people suffering from depression?
 - how much do we really know about what is good and bad for us and how much is fashion/fad?
 - are there some simple rules of thumb for deciding how much of what one should be eating? is there an ideal diet?
 - issues relating to public health e.g. standards for food industry, use of hormones in animals used for food, food irradiation
 - disease transmission e.g. from infected animals to humans

- iii. Food production e.g. where and what does it come from?
 - how was it grown? how is it produced?

DIPLOMA IN PRIMARY SCIENCE EDUCATION

Module B January 1990

RESPONSES TO QUESTIONNAIRE ABOUT TEACHING ABOUT FOOD

A. Introducing the topic - possible starting points:-

1. **Events** in school e.g. festivals
2. **Discussion** about -
favourite foods/meals; foods liked/disliked
food at school and at home
3. **Questions** - e.g. what do we understand about
healthy eating?
4. **Activities** - selection of different foods;
observation work - link to art - or
grouping according to pupils' own
criteria e.g. favourite foods,
5. **Stimulus material** - "Take a shopping bag into the
class full of my weekly shopping,"
"A meal set out (to observe!)"
6. **Cooking**
7. **Growing seeds** e.g. beans
8. **Visits** e.g. shops, school canteen
9. **Current events** e.g. reports of famine
10. **History** e.g. meals in history

B. Food grouping - five different systems were suggested.

The first - based on foods such as fruit vegetables,
meat/fish, cereals and cereal products, dairy foods,
drinks - was mentioned most frequently (6 people);

The other four systems were each mentioned once or
twice:-

1. **Food function** e.g. food for energy, health,
body building,
2. **Healthy/unhealthy,**
3. **Children's own groupings,**
4. **Nutrient groupings** e.g. fats, carbohydrates,
protein.

C. Ideas/concepts which children find difficult to understand

- "what exactly food is and why we need to eat,"
- "the need to actually try to put into practice what they learn,"
- for young children food as source of 'heat'-confusion with "heating and steam coming out",
- "the gaps between the natural material e.g cereal and the finished product."
- how taste buds work.

One person wrote:-

"Some children, particularly first years or slow learners seem to have a poor general knowledge about where different types of food come from - this may be considered typical of inner city children but can be startling nonetheless."
"Children do not like to think of how chicken or meat arrives on their plate."

SAT 30.1.90

APPENDIX XI

Teaching science: assignments for teachers

APPENDIX XI

SCIENCE EDUCATION DEPARTMENT, INSTITUTE OF EDUCATION

24.1 PRIMARY SCIENCE FOR CURRICULUM COORDINATORS

DES 20 DAY COURSE 1990/91

ASSIGNMENTS

During the course there are four assignments which you are asked to undertake:

1. **Diary of coordination**
2. **Investigation of children's understanding**
3. **Report on the teaching of a science topic.**
4. **Individual practical assignments**

The assignments are designed to help you in your role as a curriculum coordinator. The assignments are linked closely to your work in school and should assist you to reflect on your practice and to evaluate your teaching of science. Successful completion of these assignments forms accreditation for two modules of the six module Institute Diploma in Primary Science Education.

1. DIARY OF COORDINATION

We suggest that you keep a diary of your work as a coordinator during the course. The diary is private but you will find that entries will be useful as a basis for discussion with colleagues in school and on the course - and as a means of showing you how much you have achieved in a few weeks!

2. CHILDREN'S UNDERSTANDING (Module B)

Please see separate sheet for details of the assignment. Time is allocated during the course for undertaking the work with children in school and for writing the report on your interviews. You should complete this piece of work, at least in draft form, before the end of February so that the final piece of work can be submitted by the end of this term.

3. TEACHING A SCIENCE TOPIC (Module A)

The purpose of this assignment is that you become a researcher into the developing scientific understanding of the children in your class. The report should be based on your own teaching during the spring/summer term (on about a ten hour science topic), as well as on your reading.

Identify concepts which you want to develop and analyse how the learning activities and experiences you plan will contribute to these concepts and the skills and processes they should help to develop.

Use teaching strategies and formative assessment techniques which will elicit children's thinking at various points of the topic. Comment will be expected not only on the development of skills, processes and concepts, but also on the interrelationship of these three.

Your final report should be not more than 4,000 words (excluding references, bibliographies, appendices and samples of children's work).

The structure of the report is not specified. Also in monitoring the children's changing understanding, you are free to decide how to do this; for instance, you may decide to follow say six specific children throughout, or perhaps try to monitor the whole class and identify significant trends. The evidence you give can come from classroom observation, tape recordings, analysis of classroom products such as drawings, models and writing. If your school is trialling specific assessment techniques, use these and give a critical comment on their usefulness.

This assignment should be submitted, at least in draft form, by the end of May 1991 so that the final submission can be handed in before the end of August 1991. This timetable will make it possible for you to discuss your work with tutors before you submit the final report.

4. INDIVIDUAL PRACTICAL ASSIGNMENTS

These assignments will be similar to questions set in the old diploma in primary science practical examination and consist of simple practical investigations e.g. observing the effect of heating substances. There will be opportunities to try assignments a second time if your performance is judged not to be satisfactory.

NOTE

You will find general guidance on writing essays and referencing them in the Diploma Handbook. The handbook also contains suggestions on appropriate background reading.

SAT - 12.1.90

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APPENDIX XII

Planning for teaching: Feeding the family

APPENDIX XII

PLANNING FOR TEACHING - From report by a teacher

TOPIC - FEEDING THE FAMILY

As a follow up to early infant work on 'Myself' and 'My Family', 'Feeding the Family' can include topics on shopping and Food as both will involve much practical and language work and both are linked to children's immediate experience.

Key Questions: Why do we need shops?
Which shops do we need the most?
How near is it to where we live?
Where do most people buy their food?
Where do the sick and elderly buy their food?

The work will involve visits to the local shopping precinct and corner shops, walkabouts and talkabouts which require children to plot the shops in the area. The autumn term would be a good time for this topic in our school as we decorate mushroom baskets and fill them with food for gifts for the elderly in our locality at Harvest Time and include an invitation to a Christmas Concert and Party. The sorting of food into groups could be done by the younger children, followed by discussion on how we should fill the baskets ensuring a balance of drinks, soups, meat or fish, cereals, dairy products, fruit and vegetables.

The idea that shops fulfil a need can be developed.

Key Questions: Are shops the same all over the world?
Do any of our shops reflect that there are people from other countries who live here?

A shopping centre could be created within the Infant building:

Tuck shop - develop the idea of healthy snacks
Greengrocer's shop
Grocer's shop
Dairy

Collect labels, pictures and posters of food from plants and animals, and empty packets of food to develop further the ways to classify more scientifically.

Look simply at means of preserving food.

Key Questions: How/where do we store food at home?
Why is some food frozen/tinned/smoked?
Why do some foods perish?
Why do some foods come from hot/cold countries?
Do we all eat the same sort of food?

If not, why not? - preference
economy

Look at feeding habits of birds, find out about feeding habits of other animals.

Key Question: Do all living creatures eat?

Practical shopping, and discussion and sentence structure in Maths and Language areas e.g. I went shopping and I bought an apple, a banana ...

Using names of any food/groups of food

Develop picture dictionaries of products and simple stories of products e.g. A packet of crisps from farm to packet.

Visits to a bakery and the school kitchen. Discuss meals.

Key Question: What did we have for
breakfast/lunch/dinner/snacks?

Make models of food on paper plates. By looking at the plates discover our needs, the value of what we eat, the beginning of the idea of a balanced diet. Involve the school cook. Look at school dinners and begin to build up the idea of a balanced diet. School dinners can be compared with packed lunches.

Key Questions: Where does food come from?
How is it prepared?
How popular is it?

A class restaurant can be set up.
At Harvest time concentrate on the seed, the wheat, the bread and link with stories such as 'The Little Red Hen'.

The school conservation area has a chequer board garden and an allotment and more contact with these areas are needed from a younger age.

Tasting sessions can encourage children to categorize fruits for instance. Apples, pears, oranges, lemons, grapefruit, pineapples, kiwi fruit, bananas and so on, can develop much language work and encourage language skills.

Source: Report on interviews with children GPC 1989

Appendix XIII

IDEAS FOR TEACHING ABOUT THE TOPIC OF FOOD

Prepared by Participants

24.1 DES Science for Curriculum Coordinators Workshop

28th February 1991

1. Food
2. Food Preparation
3. Making Choices
4. Fruit and Vegetables
5. Developing Activities Based on the Sense of Smell

FOOD

Group I

Infants:

Sorting & Classifying	Colour	Meals - pairs e.g. fish & chips "REAL THINGS"
	Taste	
	Touch	
	Smell	
	Sound	

Activity eg. shaping, cooking and eating

Growing things eg. cress, sunflowers, nasturiums
pumpkins and tomatoes

Packaging - look, discuss and make eg. a bag to carry potatoes

Health - good things, bad things (emphasise positive)

Juniors and Middle:

Sort and Classifying	Closer Observations	"DATA BASE"
	Subsets	
	Similarities and Differences	
	"Pictures and Real Objects"	

Activity:- vegetable dyeing, fruit printing, looking at seeds and parts of plants and animals

Growing things - fair testing, rates of growth etc.

Food and climate - regional differences

Packaging - strength etc. technology
information base about nutrients etc.

Processing - cooking, freezing, melting etc.

Activities - chromatography, rotting and decay, starch test

Biology - digestive system, energy, food chains, basic health education

Group II

1. BASIC EXPERIENCES

Developing the use of the senses

TASTING SMELLING FEELING POURING

Dissolving using a variety of foodstuffs such as sugar, salt, flour etc.

2. PREPARING FOOD AND DRINK

TALKING ABOUT WHAT FOODSTUFFS ARE LIKE AND WHY WE NEED THEM

FINDING SIMILARITIES AND DIFFERENCES

Between foods - using a wide variety of foods as experienced by your pupils
eg. different types of bread - pitta - chapatis - nan

DIETARY CUSTOMS OF DIFFERENT CULTURES

3. WHAT HAPPENS TO FOOD WHEN IT IS PREPARED

Investigate what changes occur to food when it is boiled - cooked - frozen - fried - melted - burnt

CLASSIFY MATERIALS AS SOLIDS - LIQUIDS - (GASES).

Measuring weights and volumes of food materials during their preparation

Dangers in kitchen eg. hot oil - sources of heat.

4. MICROBES AND FOOD - LEARNING ABOUT AND CONTROLLING CHANGES

Using micro organisms to help make yoghurt - cheese - bread
NB. Safety guidelines (DES and LEA)

5. FOOD CHOICES - FOOD PREPARATION AND HEALTH

Taking responsibility for myself and my effect on the environment

Wide variety of diets and reasons why they made that choice.

Group III

Fruit and Vegetables

On Going

Senses (Early years)

1. Sorting
- colour, size, citrus, skin texture, "foreign", seasonal, smell, weight, size, countries of origin.
2. Predicting - look at more unusual fruits - what colour do you, they'll be like inside
3. Tasting - sweet, sharp, sour etc.
4. Feel - Do fruits of similar appearance 'feel' the same
5. Smell - Can you guess fruits solely from smell

Stories
Harvest
Divali
Lent
Poems
Rhymes
Cultures
Ramadan
Passover
Communion
Sikh
Sharing
(Temple)
Xmas
Easter
Vegetarians

Painting pictures of fruits
Veg/Fruit models/Animals
Black..... tie dye

Inside Fruit/Vegetables (Middle years 7-9 years)

Exploration of the different part of fruit - similarities and differences - graphs, diagrams etc.

Prediction - how many pips/seeds in veg/fruits
can you eat the skins - if not why not?

more detailed exploration of senses in comparative contrasting role

Ripening fruit

Grow seeds/pips - keep careful records

Health (9-11 years)

Health value (specific) vitamins, minerals etc.

Close analysis - thickness of pit h

- reasons why pips in some fruits have "jelly"
- dispersal properties
- why do we eat some pips - not others

Geographical reasons for food growth - climate/valleys/shelter/
preserving/cooking fruits/vegetables - dried fruits
Rot/decay if left - try different situations - (NB Safety Aspects)

Food - developing activities based on the sense of smell

Early years Provide a small range of food items familiar to the children's experience (suggest 4 maximum) e.g. fruit (orange, lemon, banana)

- Discussion
- (i) liked/disliked smells
 - (ii) matching food to smell
 - (iii) matching smell to place/location

Development Include similar/closely linked smells e.g. orange/lemon/apple/pear. Introduce strong/soft smells to encourage discussion on how strong smells may effect our ability of detecting smells.

Develop ideas of what is a fair test.

Children suggest changes they wish to make.

Emphasis needs to be placed on collaboration/cooperation in order to solve the problem. Increase samples (wide range of samples).

Group size. Account needs to be made of group size and its impact on results. ie.. handling of the samples and strategies adopted by the children. What other clues/knowledge are the children using. Extension/develop/link with other senses ie.. hearing.

Points to consider/question

1. What direction/language is used by teacher?
2. What opportunities are provided for children to discuss/raise question/and plan an investigation.
3. Teachers role in investigation. Observer/facilitator/assessor
4. Take account of background/previous experience of children. Food at home/school.

REF: DIPLOMAS 2/COURSE 24.1/IDEAS FOR TEACHING