The influence of direct experience of the physical environment on concept learning in physical geography

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Abstract

This investigation examines the relationship between children's direct experience of the physical environment and their conceptual understanding of it.

In order to determine the extent of the influence of the physical environment on understanding, two groups of children living in different geographical environments were selected and their perceptions and understanding of the selected physical features related to their immediate surroundings were compared.

The children's ideas about the features selected were examined using a number of research techniques. The results tended to support the central assertion of the study that the physical environment has an influence on children's conceptual understanding. The data also showed that the children held a number of alternative conceptions about their near and far environment prior to the experience of formal instruction.

The relevance of these conclusions for geographical education is presented. Suggestions are made to improve the quality of teaching and learning in physical geography. Fieldwork, hardware models, simulation activities and Information and Communication Technology (ICT) are suggested for use as teaching approaches. The significance of the conclusions in the context of Turkish geographical education are also considered.

The Influence of Direct Experience of the Physical Environment on Concept Learning in Physical Geography

by

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Thesis submitted as a requirement for the degree of Doctorate of Education

School of Education

University of Durham

1999

Acknowledgement

I would like to thank Michael McPartland and John Halocha, my supervisors, for advice, encouragement and criticism in the production of this thesis.

I should also like to acknowledge the support of the Turkish Government in funding my fees, maintenance and expenses.

Of course, the study would not have been possible without the children and teachers of the two schools in which it was carried out.

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Declaration

This thesis results from my own work and has not been offered previously in candidature for any other degree in this or any other university.

Statement of Copyright

Chapter One

Introduction

INTRODUCTION

1.1 Origins of the Study

In October 1996, I began to investigate the relationship between children's understanding of some physical geographical concepts and their direct experience of the physical environment. My interest in this originated from my own teaching experience. After graduation from university, I was appointed as a geography teacher in a middle school, in a village located in a plain in the north east of Turkey. In accordance with the curriculum, I was expected to teach about the elements of physical geography, such as the origins and formation of valleys, mountains, plains, rivers and so forth. In the second term, I taught the children about plains. The result was quite positive: about 70% of them seemed to understand what a *plain* meant. However, when I tried to explain a *valley* by using the same teaching techniques which were verbal and pictorial description, most of the children did not understand. I attributed the children's performance in understanding of concept of *plain* to the fact that they had already developed some knowledge about a *plain* via direct experience. On the other hand, their failure to understand the concept of a *valley* was attributed to their lack of direct experience of a valley. In short, I attributed the reason for the difference in children's performance to their background knowledge of physical geography and pondered whether a child's direct experience of the physical environment might influence their conceptual understanding of it.

1.2 Need for the Investigation

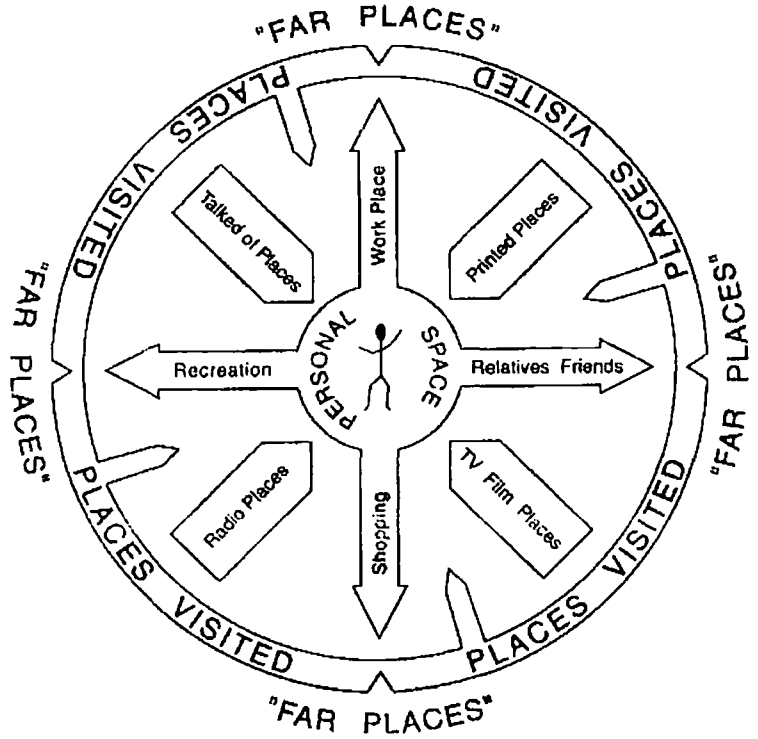
The aim of this investigation is to explore the influence of the physical geographical environment on young children's concept learning.

Children obtain information about geographical environment from both direct and vicarious experience before taking formal instruction.

A model which describes children's sources of information about places is provided by Goodey (1971). According to the model, children are located in their own 'personal space' which they experience directly via play and interaction with their immediate environments. With age the extent of their 'known world' increases as they attend school, visit friends and relatives, go shopping and go on holidays. However, they also come to know places through vicarious experiences. That is, they receive information about distant places through indirect information, such as picture books, radio and television programmes, newspapers and hearsay (Wiegand, 1992).

As can be seen, Information and Communication Technology (ICT) was not included into Goodey's model a sources of information, because it is a relatively new development. That is, in the present day, children also have an opportunity to gain geographical information about distant places via the Internet, CD-ROMs, multimedia resources, electronic mail, and so on.

Figure 1.1 Children's Sources of Information



Source: Goodey, 1973, p.7

Therefore, it might be speculated that children already possess a knowledge base about their immediate and distant environment. The knowledge they construct might be either rudimentary or sound, depending upon how they received and assimilated the information. Palmer (1993) suggested that the knowledge they build through indirect experience might be incomplete or even false

Accordingly, it is important to develop appropriate teaching strategies to integrate new ideas into children's existing knowledge, because as Vosniadou (1991)

indicated, a learner's ability to learn something new is dependent on the interaction between the information that currently exists in the knowledge base and the new information to be acquired. When there are gaps in the knowledge base, the result may not be successful learning. Therefore, it is important to know the ideas that children develop before formal instruction.

In addition, children's pre-instructional knowledge may contain alternative conceptions (Ault, 1984; Stepans and Kuehn, 1985; Bezzi, 1989; Ross and Shuell, 1993; May 1998). It is, therefore, important to discover the alternative conceptions in order to adjust them, because there is a danger that children's alternative conceptions may pass unnoticed and thus, persist over years.

Although it is widely accepted that children's initial ideas should be taken into account as starting points for teaching, very little research has been undertaken regarding children's pre-instructional knowledge base in physical geography. In order to determine children's knowledge, the factors that influence concept acquisition should be considered. My teaching experience mentioned above and the literature (Sheridan 1968, Wilson and Goodwin 1981, Stepans and Kuehn 1985, Harvey 1990, Harwood and Jackson 1993, Wiegand 1993, Platten 1995a and May 1998) shows that children's immediate environment is one of the most important factors that affects their understanding of geographical concepts. Therefore, it was considered that there was a need to investigate the influence of direct experience of geographical environment on concept acquisition.

1.3 Feasibility of the Investigation

It was anticipated that there could be some problems and difficulties that could arise during the course of the investigation. It was, therefore, vital to foresee these before conducting the research so that we could avoid them. Assessing the practical feasibility of the investigation was one of the most important issues that had to be taken into consideration in order to avert these problems.

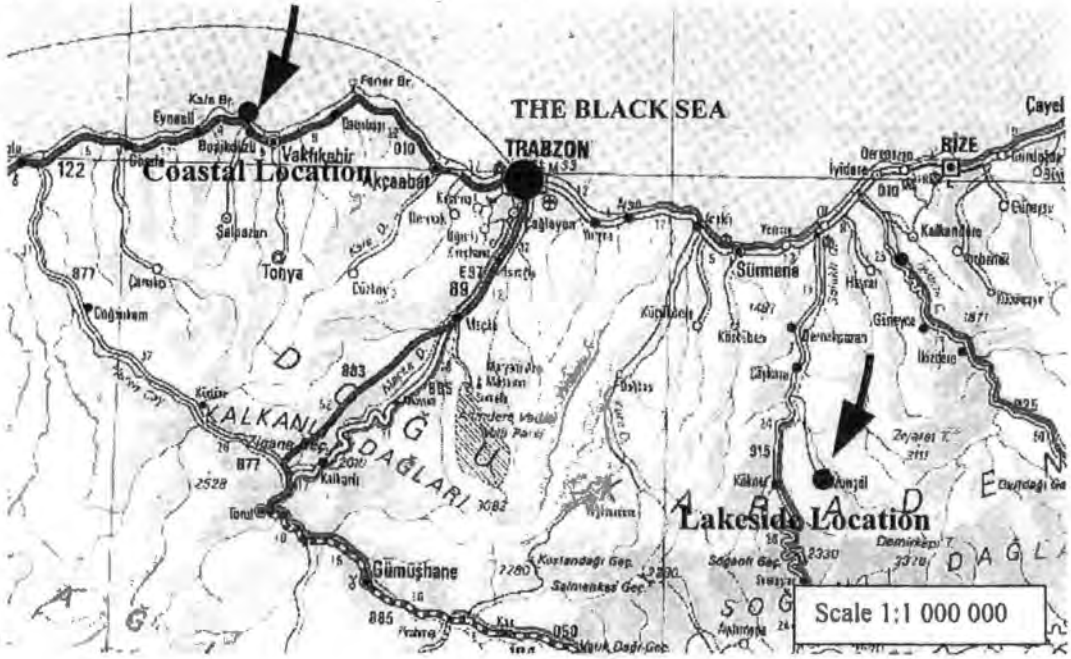
One of the most important stages of assessing the feasibility of the investigation was to determine the availability of the subject of research. In order to understand as far as possible the effects of the environment, it was necessary to draw samples from different geographical locations. The selection of these locations was based on two major criteria. One was that their geomorphologic features must be different from each other in order to make a comparison of the effects of the physical environment on children's knowledge. The other was that the participants who lived in these places must have a broadly similar socio-economic make-up so that this factor could be regarded as a secondary effect. For the purpose of the investigation and using these two criteria, it was decided to choose two locations, one coastal and one inland in the Black Sea Region of Turkey (Figures 1.2 and 1.3).

The coastal location had its own distinctive features. A massive range of mountains lie immediately parallel to the sea and is steeply dissected by rivers running at right angles to the coast. Consequently, the coastal area is characterised by

high and steep cliffs and headlands with interfluves. Another feature of the place is the presence of small deltas where rivers join the sea. Photographs 1.1 and 1.2 depict the coastal place.

Figure 1.2 Location of the Study Area within Turkey. The arrow points to the province of Trabzon where the Study took place.

Figure 1.3 Location of the Study Area within Trabzon. The arrows point to the coastal and lakeside locations.



Photograph 1.1 A View of the Coastal Location. The arrow points the location of the school.

Photograph 1. 2 A View of the Estuary in the Coastal Location. The arrow points the location of the school.

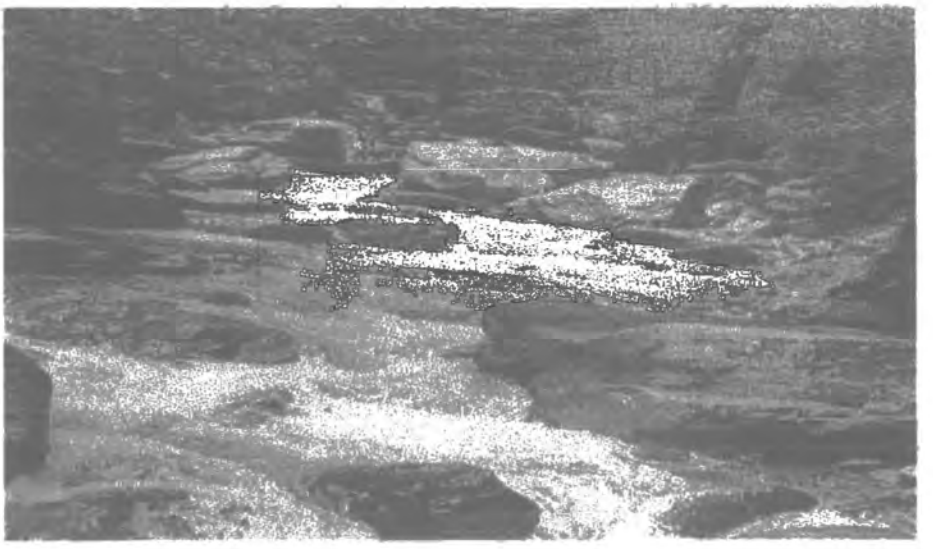
On the other hand, the inland lakeside location was situated in a deep and steep V-shaped valley formed by the river Haldizan which flows to the Black Sea (in the south-north direction) after receiving many tributaries. Since the distance between the sea and the summits of the mountains (more than 2500 metres in elevation above sea level) which lie just behind the Black Sea is very short (approximately 40 kilometres), the river is characterised by a steep gradient and swift-flowing current. Another important geomorphologic feature of this place is the presence of a small landslide lake which is at an elevation of 1250 metres. The lake was formed as a result of the collapsing of a natural landslide across the river (Photographs 1.3 and 1.4).

These two sites selected for this investigation showed fundamental similarity in terms of the children's socio-economic background. Both were residential, suburban areas where income levels were relatively low and unemployment was high.

In addition, my familiarity with the region was another reason for choosing these two research sites. Knowing the research area would be extremely useful in terms of the validity and reliability of the research, as a researcher who is familiar with the vernacular language used in the region would minimise any possible misunderstanding in the course of the communicating with children.

Photograph 1.3 A View of the Lakeside Location. The arrow points location of the school.

Photograph 1.4 A View of the River in the Lakeside Place



1.4 Definitions of the Terms Used in the Investigation

It is vital that certain terms should be defined in order to avoid any confusion over the meanings of words used in this dissertation.

Alternative Conception: Osborno and Gilbert (1979), Nussbaum and Novick (1982) and Driver (1983) argued that children bring to the classroom views which are usually different from those that are held in schools and by scientists. Driver and Easley (1978) proposed that these views be called *alternative conceptions* rather than *misconceptions*, because children hold them even before they have been exposed to teaching. The difference between misconceptions and alternative conceptions is that while the former arise as a result of failure to understand properly the concept being taught in schools, the later arise from children's personal experience of natural phenomenon before formal instruction. Pines and West (1983) suggested that alternative conceptions form part of that knowledge that may be called "naïve knowledge", "intuitive knowledge" or "gut-knowledge". They stated that this knowledge is influenced by language, culture, other individuals, first-hand experience of the environment and so forth. Therefore, since the children in the current investigation had not been taught about the concepts in school, the terms *alternative conceptions, alternative framework, naïve beliefs, intuitive knowledge* and *preconception* will be used rather than *misconceptions.*

Artificialism: This term is used for the tendency to view natural phenomena (such as the sun, the sea, thunderstorms and rain) as having been created by humans or God.

Conception: This is a term which can be described as "mental process of forming a concept" (Reber, 1995, p.147).

Perception: According to Hall (1976), perception is making sense of information through the sensations of seeing, feeling, hearing, touching and smelling and their interpretation in the light of previous experience.

Stimulus: This term refers to "any thing (i.e. any event, any occurrence, any change in a thing, any precept, or concept, internal or external) that has some impact or effect on an organism such that its behaviour is modified in some detectable way" (Reber, 1995, p.756).

Distinctive Feature: The term can be defined as an attribute of a concept that is critical in distinguishing the concept from others. The terms *critical features*, *critical attributes*, *distinguishing features* and *distinguishing attributes* will be used as synonyms of *distinctive features*.

Untutored Children: This term describes children who have not been formally taught about geographical concepts in school.

Schemata: Schemata are cognitive structures that organise events as they are perceived by the organism into groups according to common attributes. They are repeatable psychological events in the sense that the child will repeatedly classify stimuli in a consistent manner (Wadsworth, 1971).

Chapter Two

Literature Review

LITERATURE REVIEW

2.1 Introduction

This literature review has focussed on the assertion that children's direct experience of the geographical environment is one of the most important sources of knowledge in physical geography. A review of the literature has suggested that children's knowledge before the start of formal instruction might be influenced by the characteristics of the physical environment in which they live. Besides the environmental factor, there might be other factors such as the nature of the geographical concept, children's age and socio-economic background and the characteristics of the learner which might influence a child's conceptual knowledge of the physical environment.

The first part of the research review attempts to present a definition of a concept, classification of concepts and the common theories regarding concept acquisition. The discussion then turns to explanations of factors which might influence children's knowledge about the physical environment.

2.2 Definition of a Concept

Since we are going to consider the effects of the physical environment in concept formation, it is important first to make clear what we mean by a concept.

A review of the literature has shown that there is no rigid definition of a concept. Some definitions of a concept are given below:

> A concept is a general idea, usually expressed by a word, which represents a class or group of things or actions having certain characteristics in common. (Quillen and Hanna, 1961, p.187)

> We define concept as ordered information about the properties of one or more things – objects, events, or process – that enables any particular thing or class of things to be differentiated from and also related to other things or classes of things. (Klausmeier, Ghatala and Frayer, 1974, p.4)

> We could say that a concept is an abstraction from events, situations, objects or ideas of the attributes which they have in common. (Graves, 1980, p.35)

> We can define a concept as a mental representation or idea that includes a description of important properties of a class. (Medin and Ross, 1997, p.370)

A new definition might be made by taking the essential characteristics of these definitions: a concept can be defined as an object, process or event that has a number of common properties or features which enable us to classify and differentiate it from others.

2.3 Classification of Concepts

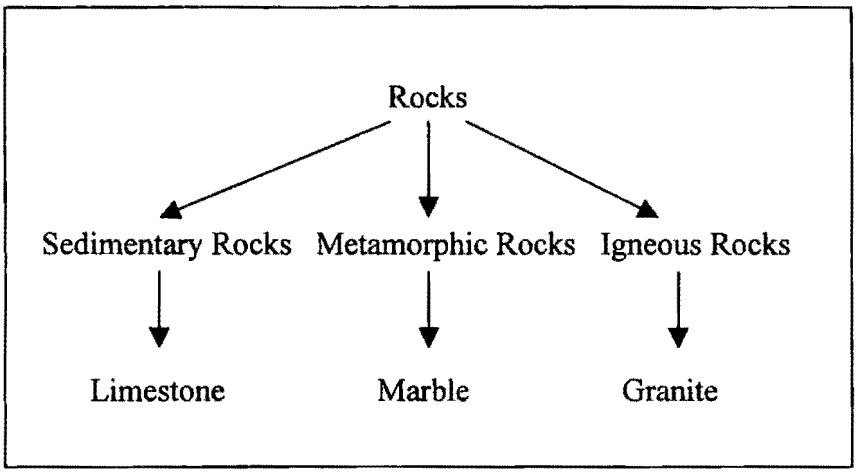
Graves (1975) classified concepts into two groups according to their nature: abstract and concrete. He named them *concept by definition and concept by observation* respectively, since the former can only be defined rather than observed.

For example; the concept *development* can be learned by using verbal statements while *a factory* can be distinguished from the other types of building through observation.

Marsden (1995) made a more comprehensive classification by taking into account two aspects of a concept. The first one includes the abstract and concrete dimension. As has been explained above, these two dimensions can be differentiated using the criteria of whether they can be experienced through our senses. The second dimension of the classification scheme relates to whether it is a technical or vernacular concept. The technical (scientific) concepts (*plateau, basin, lagoon, cuesta, dyke,* and so forth) require instruction and a special vocabulary to be understood. On the other hand, vernacular (everyday) concepts are developed through everyday speech and direct experience. For instance, the concept of *mountain, river, lake* and *the sea* can be acquired without systematic instruction because of the fact that they are widely used by people in everyday speech.

Graves (1982) grouped concepts according to a hierarchy. Concepts can be arranged from higher to lower depending on how difficult they are. To achieve the higher level the learner must be able to assimilate concepts at the lower level. That is, attainment of the prior level is a prerequisite for attaining the next level. A detailed example of a hierarchy of concepts is given below.

Figure 2.1 A Hierarchy of Concepts



The figure shows that *Rocks* are superordinate to *Sedimentary Rocks*, *Metamorphic Rocks* and *Igneous Rocks* which are in turn superordinate to *Limestone*, *Marble* and *Granite* respectively. Therefore, limestone cannot be understood unless the concept of sedimentary rocks has been acquired.

A concept might also be classified according to its level of complexity (Kaminske, 1997). Some concepts are very difficult to understand since they incorporate many variables and there is a close relationship between these variables. These kinds of concepts are called complex concepts. For example; *radiation*, *temperature*, *air*, *wind* and *precipitation* are the elements of the concept 'windward'. Therefore, it is necessary to know these elements and make a logical link between them so that the concept can be understood. However, there are other concepts which are less difficult and not so complicated. These kinds of concepts are termed simple

concepts because of their easy structure or definition, such as a *mountain, river*, and *lake*. That is, they incorporate fewer variables.

In summary, an analysis of these views shows that concepts may be classified in different ways, depending upon the criteria that have been applied. The criteria we have used for the classification of the concepts are whether the concepts can be seen or observed directly and whether they are difficult to understand. These two criteria are firmly related to each other. That is, the more abstract the concept the more difficult it is to understand.

After defining and classifying concepts, it is necessary to look at how children learn concepts.

2.4 Learning Theories

Much of the work in the field of educational psychology has been strongly influenced by Skinner, Piaget, Bruner, Vygotsky, and Donaldson concerning concept learning. It is, therefore, necessary to summarise their theories.

Skinner's theory, called 'behaviourism', is based on the stimulus–response relationship (Skinner, 1938). For Skinner, the theory explains not only how learning can be shaped but also the control of organisms' behaviour. In this type of learning, respondent behaviour is elicited by specific stimuli. Given the stimulus, the response occurs. Then the response is gradually developed using reinforcement. The reinforcement could be either giving a reward called a positive reinforcer, or using

punishment, that is, a negative reinforcer. This type of learning is known as operant behaviour. An investigation undertaken by Kirby and Shields (1972) gives a good example of how this kind of learning occurs. In the first session of a positive reinforcement program, the teacher gave a thirteen-year-old boy a problem to solve. The teacher then corrected and returned it the next day without saying anything. In the following sessions a number of similar tasks were presented to the child. Unlike the first session, the child was strongly praised as soon as he had finished the task (positive reinforcement). The experiment showed that the child was much more successful with the task in the period of positive reinforcement than in the first session.

Unlike Skinner, Piaget's theory addressed learning from a cognitive rather than a behavioural view and was among the first to give more attention to mental process and structure than to stimuli and response. A major aspect of his theory is that cognitive development occurs in certain periods in the course of an individual's life. These periods called stages of development are identifiable. They are the same for all children but differ between children and adults.

Piaget (1969) identified four different stages in the cognitive development of an individual: the sensorimotor stage, the preoperational stage, the concrete operational stage and the formal operational stage. The sensorimotor stage covers a period roughly from birth to the age of two. In this stage, the infant learns about the world in terms of physical action. During the preoperational stage, from the age of two to six or seven, the child gradually develops internal mental representations. The

understanding and interpreting of concepts are limited during the course of this stage. The concrete-operational stage (approximately from ages eight until eleven or twelve) is marked by children's ability to work things out mentally. The last stage of cognitive development occurs from the age of eleven or twelve onwards. The child is now able to use scientific reasoning and to cope with harder concepts and more complex tasks.

According to Piaget, the child can only pass on to the next stage on the condition that the previous one was mastered completely. Therefore, it might be concluded that concepts are learned step by step.

Children move from one stage to another through *assimilation* and *accommodation.* Assimilation is the integration of external elements or input into existing schemata. All behaviour is grafted into existing schemata, and therefore involves assimilation. If however only assimilation were involved, we could not account for change or development. According to Piaget, there can be no assimilation of input to existing schemata without these schemata being modified thereby. This counterpart to assimilation is accommodation and refers to the modification of schemata by the elements its assimilates (Geber, 1977).

The main characteristic of Piaget's investigation is that he develops a hypothesis by observing the child's environment and behaviour. His research methods were to hold conversations with children in which he would ascertain the level of their response. The main concepts involved in his studies were *number, time, velocity, space, geometry, change* and *morality.* He also investigated children's ideas

about *clouds, rain, wind, snow, ice, mountains, the sun and the moon* in terms of his stage theory.

There has been criticism made of Piaget's research methodology. Firstly, he took little account of the complexities of language development, although language was the chief source of data for him. His experiments also were too difficult and complicated for children since they were applied in an unrealistic context. The results of the investigations conducted by Bower and Wishart (1972), Bryant (1974), Donaldson (1987), Wood (1995) suggested that children could think more logically and they could be more successful, if the tasks were made less verbal and set within a meaningful context.

A second criticism could be that he generalised the findings although he used only children who lived in Geneva, Switzerland, in his experiment. Over fifty cross-cultural investigations have indicated that culture influences cognitive development (Werner, 1972). For example, children from a non-Western culture demonstrated psychomotor accomplishment at an earlier age than did the children from Western culture (Strenberg, 1996). Therefore, it might be argued that Piaget's findings are valid only for children in Western society, because children in both cultures might not have the same mental development.

A third criticism could be that he maintained that cognitive development is a spontaneous process. That is, cognitive development is dependent on biological evolution and adaptation rather than social interaction. This view has been criticised by many researchers, especially Vygotsgy. His ideas about cognitive development are

found in his book *Though and Language* (1962). He suggests that children's cognitive capacity might change as a result of interaction with adults and peers. His theory will be explained more in a subsequent section.

Bruner's learning theory in some respects parallels that of Piaget. For example, he also believes in a developmental sequence in concept formation. He suggests that there are three ways of knowing something: through doing it (enactive), through seeing an image or picture of it (iconic), and through a symbolic form of it (symbolic). However, his theoretical ideas do not accord with Piaget in a number of important ways. Firstly, although he recognises a progression in preferred modes of representation as the child advances in age, from enactive to iconic to symbolic, he does not claim that it is related to stages of development. He maintains that children and adults represent experiences enactively and iconically throughout their lives, not just during certain stages or the earlier years. That is, an individual who passes through all the stages may still use the enactive or iconic mode of representation when appropriate. Secondly, Bruner (1960) suggests that a concept might be acquired by children at any stage of their cognitive development provided that the structure of the concept is not complex. This belief could imply that the instruction given to children might help in the development of their cognitive capacity. However, Piaget's theory claims that since cognitive development, which results in concept formation, is dependent on biological evolution and adaptation rather than instruction, some concepts cannot be acquired by a child until he or she reaches a certain stage.

On the other hand, Vigotsgy (1962) believed that language plays an important role in the evolution of concepts. He maintains that ideas develop in the child at an *intermental* level, (talk between peers and adults) and then become internalised at an *intramental* level, (within the individual). Therefore, for Vygotsky, all learning is a product of social interaction (Baumann, et al. 1997). For example, children watch what adults and their peers say and how they say it, what they do and how they do it within their social environment. Then they internalise what they have experienced, making it their own.

Bruner's theory, explained above, stands somewhat between those of Piaget and Vygotsgy. Like Piaget, Bruner stresses that cognitive development is one of the most important factors related to concept learning. At the same time, he emphasises, in agreement with Vygotsgy, the importance of social interaction in concept formation and the use of language in that interaction.

Margaret Donaldson was interested in both Piaget's and Vygotsgy's ideas about the development of children's thinking, the significance of language and the relationship of language to thought. Although she produced a number of papers on these topics, *Children's Mind* (1978) is her best known book and mainly focuses on a criticism of Piaget's theory of intellectual development. She stresses that Piaget underestimated the mental capacity of children because they had difficulty in understanding the tasks he had given to them, because they were set in unusual contexts.

2.5 Concept Formation

Children learn a large number of concepts in the process of the physical and mental development. These concepts are learned via their experiences both in and out of school (Graves 1975).

Klausmeier et al (1974) suggested that concepts are acquired at four levels: the concrete level, the identity level, the classificatory level and the formal level.

The concrete level is indicated when the individual recognises an object that he has encountered on a prior occasion. To attain this level, the learner must distinguish the object from others. The discrimination of objects involves attending to distinctive features that serve to distinguish the object from others. The attainment of a concept at the concrete level thus requires attending to the distinctive features of an object and forming a memory image which represents the object as a unique bundle of features. For instance, when the child knows the distinctive features of a *river*, he has attained the concept of a river at the concrete level, because he or she can distinguish a river from a lake or other features. The concept at this level may or may not be associated with the name of the concept, depending upon whether the label has been acquired and remembered, and whether it has been associated with the concept.

The identity level is indicated when the learner recognises an object as the same as one previously encountered when observed from a different perspective or seen in a different modality. While concept formation at the concrete level involves only the discrimination of an object from other objects, attainment at the identity

level involves both discriminating various forms of the same object from other objects. For example, the child shows understanding of the concept of a *river* at the identity level, when he identifies different types of river (fast flowing, slow flowing, meandering and so on.).

The classificatory level is indicated when the learner treats at least two different objects of the same class as equivalent, although he may not be able to describe the basis for his responses. For example, when the child classifies a *river*, a *stream* and a *spring* as flowing water and excludes *the sea,* a *lake* and a *pool* from this category, he has attained the concept of *river* at the classificatory level.

The formal level is indicated when the individual can give the name of the concept, can name its socially or scientifically accepted defining features, correctly designate examples as belonging or not belonging to the group and can state the basis for their inclusion or exclusion in terms of the defining features. As an example, the child can demonstrate a grasp of the concept of a *river* at the formal level if, when shown a river, a stream, the sea, a lake, a pool of various sizes, forms and colours, he properly designates the river as such, calls it a *river* and names the attributes that differentiate the river from a stream, the sea, a lake, a pool.

2.6 Factors Affecting Concept Formation

It is not the purpose of this section to provide a detailed literature review of concept formation. Rather, the intent is to provide a brief review of the factors that

influence concept formation in geography and focus on the effects of direct experience of the geographical environment on concept learning which is considered the central purpose of the present investigation.

Reviewing the literature in the domain of concept formation in geography demonstrates that there are several factors that might influence concept formation. The characteristics of the learner (such as chronological age, general ability and gender), the nature of the concept, children's socio-economic background and direct experience of the geographical environment appeared to be the most important factors that might influence concept acquisition.

2.6.1 Characteristics of the Learner and their influence on Concept Learning in Physical Geography

In this section, the factors of *age*, *gender* and *general ability* and their effect on geographical concept learning will be highlighted respectively.

Concerning the factor of age, a number of studies have shown that there is a relationship between children's age and concept acquisition. Children's explanations of some physical landscape features, namely *the sea*, *a lake*, and *a river*, were first investigated by Piaget (1929). He interpreted responses to his questions about these phenomena in terms of his stage theory. In the first stage, called 'artificialism', children (aged up to seven or eight years on average) explained the formation of the phenomena as being entirely made by God or man. During the second stage, named 'animism', the explanations of the children (up to nine or ten years on average)

suggest that the origin of the water of the phenomena is natural, but their bed is made by people. The third stage explanations state that everything related to these phenomena is natural.

May (1998) also investigated children's perceptions of a *river* and found that 9-10 year-old children held artificialist and animist ideas, in agreement with Piaget's findings. The children were interviewed and asked about their drawings. However, this method may not reveal what children know since the child can only talk about the features he has drawn rather than the features that are not included in the picture.

McAulay (1966) tested thirty-four second-grade children in order to determine growth in conceptual understanding in relation to some natural phenomena: *hill, mountain, stream, river, woods, forest, location, direction* and *distance*. The main characteristic of the methodology he used was that each child was taken to the playground, asked to point out the phenomena and questioned about them. In order to find out the conceptual growth in comprehension of geographic understanding the same questions were asked in September and the following May. Children were asked such questions as *Can you show me where your house is from here? Do you see any hills from where you are? What is a hill*? during the course of the fieldwork.

The findings revealed that although the children's understanding of these concepts was inadequate in September, they showed a dramatic increase in knowledge about the concepts by May. For example, while fifteen children had a good knowledge of such geographic concepts as *hill, mountain, stream* and *river* in

September, twenty-six children showed enhanced understanding of the same concepts in May.

A criticism might be made of the methodology used. As has been indicated, children were asked the same questions in September and May to reveal the growth in conceptual understanding of some physical geography concepts. It is unusual to make such dramatic progress in cognitive development within such a short period of time. Therefore, either the children had been taught or they were aware of the questions that were going to be asked since they had been asked the same questions before.

Lunnon (1969) explored children's conceptual development, the relationship between mental age and chronological age in this development and the effects of socio-economic class in concept formation in geography.

Two schools, on the same campus, were selected in the same catchment area to reduce the influence of contrasting geographical environments. One hundred and forty children, aged from five to twelve, constituted the sample. Using ten physical and human geographical concepts (*river, mountain, beach, farming, trade, desert, season, soil, clouds* and *map*) the investigator undertook both verbal and pictorial identification tests to reach his conclusions. The understanding of these concepts was assessed by means of interviewing all children individually. For each of the ten concepts, each subject was asked either *What is it* (the name of the concept)? or *What do we mean by it* ? These were standard questions to invite a verbal response. If necessary, a probing question was asked so as to elucidate or allow elaboration of the

subject's response. In addition to this, a pictorial or diagrammatic form was introduced to discriminate between exemplars and non-exemplars of the concepts.

The results revealed that growth in understanding is gradual, but occurs rapidly between five and eight years with the significant development of language in this age group, and is related more to chronological age than mental age.

With regard to gender and its influence on concept learning, investigations in this field have shown that gender difference appears in concept acquisition in geography (Sheridan, 1968; Maccoby and Jacklin, 1974; Thompson, et al. 1980; Gilmartin and Patton, 1984; Gilmartin, 1986; Matthews, 1984, 1986, 1987 and Henrie, et al, 1997). While most of these studies have focused on map use skills and spatial abilities, few of them have analysed gender differences for other subfields of geographic knowledge.

Sheridan (1968) tested fifty-five first grade children to find out their awareness of physical geographical concepts. Using an oral test and picture recognition test, he revealed that boys performed significantly better than girls on both tests. The author attributed this difference to the fact that boys generally have greater direct experience of the concept through their activities.

Matthews (1984) investigated the relationship between gender difference and children's awareness of place and their ability to represent space. He found that the different ways in which boys and girls are exposed to the environment have an influence on the development of their spatial competencies. Boys showed a much broader understanding of space, mentioning places further away from their homes

than girls and their maps were more complex in form indicating a good understanding of spatial relationship. This difference might be attributed the fact that boys have more opportunity and freedom to explore their local area.

Matthews (1987) also investigated the effects of gender-related difference in environmental knowledge and spatial ability. In the study, one hundred and sixty six children aged six to eleven years were asked to draw a map of their home area. The results showed that there were significant sex differences, both in relation to the quantitative accretion of environmental knowledge and in the qualitative manner that children were able to express their understanding of place. By the age of eleven years, boys were able to draw maps broader in conception and more detailed in content than similar aged girls and with regard to mapping ability and accuracy a greater percentage of boys managed to reproduce the environment in a spatially coherent way. These gender differences are seen to persist into early adulthood.

In summary, the existing literature (Sheridan, 1968; Maccoby and Jacklin, 1974; Thompson, et al. 1980; Gilmartin and Patton, 1984; Gilmartin, 1986; Matthews, 1984, 1986, 1987 and Henrie, et al, 1997) suggests that males are superior to females in performance of spatial tasks and amount of geographical knowledge. However, the reason for this difference is still controversial. McGlone (1980) and Harris (1981) attributed the difference to genetic and hormonal disparities. On the other hand, Keating (1976), Hart (1979) and Matthews (1986, 1987) stated that the difference can be explained by the fact that boys are given more opportunity to explore their environment.

With regard to children's general ability which is considered another factor that might affect concept learning, many studies showed that there is a strong positive correlation between achievement level and concept learning (Klausmeier et al, 1974). However, there is a distinct lack of investigation in the area of the relationship between children's achievement level and concept acquisition in geography.

Smith and Dougherty (1965) carried out an investigation which is related to this issue. One of the purposes of the investigation was to explore the relationship between children's explanation of natural phenomena and their mental ability. *The Otis Quick Scoring Mental Ability Test* was used to determine the children's mental ability. The children were divided into three groups according to their performance in the test; the highest, the middle and the lowest. The results of the investigation showed that there was a positive correlation between the children's mental ability and their explanations. The children in the highest group gave more natural responses, while the children in the lowest group gave artificial rather than natural explanations.

To summarise this section, the literature suggests that there is a close link between age and concept learning in physical geography. In addition, most of the studies concerning the influence of gender on concept learning suggested that boys have a better knowledge than girls. Regarding the influence of general ability on concept acquisition, although there is considerable lack of research in this domain, the existing literature has suggested that more mentally able children have a better understanding of the concepts than less able children do.

2.6.2 The Nature of the Concept and Its Influence on Concept Learning in Physical Geography

An early study which focussed on concept learning in physical geography was that of Milburn (1972). He pointed out that although some concepts are well understood by children, others caused great problems. He devised a master list of geographical terms based on frequency of use in the classroom and daily life to assess both primary and secondary school children's understanding of these terms. Three hundred and fifteen terms were used as a basis for testing the individual interpretation and definition of geographical terms of one thousand children, five hundred in primary schools and five hundred in secondary schools.

The result indicate that some technical and abstract concepts such as, *swamp, tributary, alp, basin, confluence, mouth, equinox, isthmus,* and *mist* caused great problems. Some concrete and vernacular concepts (e.g. river, valley, mountain, cliff) also presented difficulties for the children.

Platten (1995a) researched seven-years-old children's understanding of vernacular-technical and concrete-abstract concepts by using interview and picture recognition methods.

In her study, thirty technical and vernacular terms were chosen from the programme of study for geography in Key Stage 1 within the English National Curriculum. Three primary schools, two situated in urban areas and one in a large village, were selected to provide the sample. In these schools, twenty-four boys and twenty-six girls were interviewed individually. The interview involved asking the

child what he/she understood by the word representing each concept. In the course of the interview process the children were also shown photographs in order to help them to formulate their ideas. At the end of the interview, every child was given a score for each term, based on the cumulative understanding shown, using the whole interview process.

The majority of the children (85%) gave acceptable answers about concrete vernacular terms. However, only 42% of the children were able to express any understanding of concrete-technical terms and this decreased to 20% for abstract-technical. Of the concrete-vernacular concepts, only the term '*valley*' was revealed as a main problem, even for those children who had direct experience of mountains and hills.

The study shows that the nature of the concepts influenced the children's understanding of these concepts. Most technical and abstract concepts posed problems of understanding for young children. However, the concept *valley*, which was included in the concrete and vernacular group, was not understood by the majority of the children. This unexpected result might be explained by the fact that *valley* is not a vernacular concept for the children included in the sample, because it was not clear if there was a valley in the environment in which children lived.

Kaminske (1997) explored the effects of complexity of geographical concepts on students' understanding in certain age groups. The author described a complex concept as a stimulus which has many different variables and therefore is often difficult to understand. As an example, *radiation*, *temperature*, *air*, *wind*,

precipitation, and so forth, are the elements of the concept 'windward'. Enhanced understanding of this concept requires knowing these elements and the relationship between them.

Three hundred and forty five students, aged ten, eleven, twelve, thirteen and sixteen, were included in the research in order to find out if there is a relationship between student age and understanding of a complex concept. A climatological concept, *windward*, was selected and its elements and the link between these elements were presented to the students in the first part of the questionnaire. In the second part, they were asked questions about the concept to see what elements were understood.

The results indicated that understanding of a complex concept depends on the students' age; the older students were more able to handle a large number of elements and their relationship than the younger students. That is, the more complex the concept, the less likely it is to be understood at an early age.

In summary, the study conducted by Platten (1995a) showed that children are likely to form concrete, vernacular and simple concepts without difficulty. In contrast to the this study, Milburn's (1972) investigation suggested that children had difficulties in understanding of some concrete and vernacular concepts, such as a river, a cliff and a mountain. This contradiction might be explained by the fact that Milburn underestimated the children's real understanding, because he asked the children only for a simple definition of the concepts.

2.6.3 Social Class Background and its Influence on Concept Learning in Physical Geography

Whilst most investigations in the area of concept learning in physical geography do not address directly its relationship with the social class background of children, they recognise that one of the most important factors that influences concept acquisition in general is social class background. Social class background might affect concept learning in several ways.

Firstly, it directly influences children's language development. Bernstein (1975) pointed out that the language used by a child from a working class background might be characteristically different from that adopted by a child from a middle class background. Vygotsgy (1962), Gagne (1971) and Bruner (1973) stated that language plays an important role during concept acquisition. They claim that a concept cannot be fully developed without language. As language develops through childhood, the semantics of words modify and new meanings are attached to words already known. Although children may use the same words that adults use, the meaning of the word may not be the same. For example, *a river* has a narrower and more blurred meaning for the child than for the adult; the meaning of the word will change as the child has direct experience of a river or interacts with a river via the media or adults. Consequently, the child will acquire the meaning of the word clearly and in detail. The child will learn that a river is a stream of water which flows continuously or

intermittently in a long line over a bed towards to the sea, a lake or lower depression. Language, therefore, is seen to aid the acquisition of concepts.

Secondly, socio-economic status influences the degree of general knowledge via media coverage and literature and provides an opportunity to experience different places. Children from different social classes do not have the same chance to access information through the media (TV, magazines, journals, and so on) and travel experience.

Jahoda (1963) examined how children aged between six and eleven years develop their ideas relating to the concepts *country* and *nationality*. As a part of the investigation, he explored children's understanding of the series of geographical units, Glasgow, Scotland and Britain. The children sampled were examined through interview technique and spatial task (jigsaw arrangement). The results indicated that children from middle class areas tended to perform better than those their working areas.

Similarly, Harwood and McShane (1996) investigated children's understanding of nested hierarchies of place relationships. In the investigation, children aged, five to six, seven to eight and nine to ten years took part in assessments of their understanding of the nested relationship between home–Nuneaton-England-British Isles-Europe, using three techniques: map shading, interview and jigsaw arrangements. The results showed that the children who had travel experience outside the British Isles performed better than those who had not in every test. The authors attributed this difference to the fact that travel experience stimulates children actively

to get to know more about place relationships via consulting maps and atlases. Therefore, it might be concluded that children's concept learning might be influenced by their travel experience which is closely related to the socio-economic background.

Many investigations (Vygotsky 1962, McAulay 1966, Sheridan 1968, Lunnon 1969, Banks 1975, Nussbaum and Novak 1976, Redford 1976 and Samarapungavan et al. 1996) reveal that children's social background has a major impact on their conceptual understanding. That is, children from a higher socio-economic group show a high level of concept development.

Jervis (1984) tested ninety children (aged six, eight and ten) to find out their ideas about a *village*, *city*, *country*\ and *world*. As a part of his investigation, he also explored the data to see if there was a relationship between social class background and children's understanding of these concepts. In order to understand the influence of social class background on children's understanding of the concepts, he took the urban middle class and the urban working class as his sample.

The findings showed that middle class children mentioned a wider range of different words which they use more often than working class children to express their understanding. Middle class children showed their understanding of each concept more skilfully and with a greater confidence than most working class children. This confidence reflects the general differences between middle class and working class children regarding their knowledge and understanding of ideas.

In summary, the researches based on the influence of socio-economic background suggest that there is a positive correlation between children's socio-

economic status and concept formation in geography. The social class background of children exerts an influence upon the language they use and consequently, upon the process of concept acquisition.

2.6.4 Direct Experience and its influence on Concept Learning in Physical Geography

Studies in Environmental Psychology (Goodnow 1970, Robertson 1994 and Bonnes and Secchiaroli 1995) show that different physical environments have a different effect on an individual's personality, behaviour, environmental perception and visual thinking. This section discusses whether children's first-hand experience of the geographical environment influences their knowledge acquisition.

Sheridan (1968) presented the results of an experiment that investigated first-grade school children's knowledge about certain concepts of physical geography.

Fifty-five students were tested orally and visually by being asked thirty questions in order to find out children's ideas about the following concepts: *cloud, rain, snow, fog, thunderstorm, wind, hurricane, tornado, island, mountain, hill, glacier, plain, volcano, plateau, valley, coast, cave cape, sand dune, ocean, lake, river, creek or stream, swamp, bay, desert, forest, grassland* and *tundra.*

The findings indicated that although children's most important source of knowledge was direct experience, certain concepts which existed in the children's immediate environment caused problems. These concepts were *clouds, valley,* and

river. Accordingly, it might be concluded that the children had insufficient knowledge of some easily experienced phenomena.

Another investigation, which was related to the influence of direct experience on geographical concept learning, was carried out by Wilson and Goodwin (1981). They researched ten-and twelve-year-old children's perceptions of *river* by using drawing and writing techniques. The results indicated that the children's perceptions are closely related to their local experiences of a river and that children had a limited perception of a river in general. They regarded a river as a *natural and wide, gently flowing body of deep, cold muddy, fresh water surrounded by trees, which was quiet and beautiful and had many recreational uses, principally those of swimming and fishing* (p. 15).

This investigation might be criticised since an interview technique was not used. The children may have more sound and detailed knowledge that can only be revealed by probing and further questions.

On the other hand, ninety children of three different age groups (six years old, eight years old, and ten years old) were tested by Jervis (1984) to find out children's views about *a village, city, country* and *world*. Although the investigation was not directed towards the physical geographical concepts, it holds particular relevance to the present study since it deals with the relationship between direct experience and children's knowledge about their surroundings.

He emphasised that direct experience was not found to be significant in an understanding of these concepts. For example, children who lived in an urban area

(Manchester) did not have a better understanding of the concept *city* than the children a rural area (Charlesworth), although they were much more familiar with the city. The similarity between two ideas was attributed to children's similar vocabulary acquired as a result of their similar social backgrounds.

The study conducted by Stepans and Kuehn (1985) showed that the children using a hands-on approach had a more correct idea about the phenomena associated with weather than the children relying on textbooks.

Likewise, Harvey's (1990) findings support this conclusion in the context of botany. He assessed the relationship between children's experiences with vegetation and their botanical knowledge. Twenty-one schools, with different landscapes, were chosen in the South of England to find out if children's experiences with vegetation affected their environmental attitudes.

A large sample, four hundreds and twenty five girls and four hundreds and twenty five boys, aged eight-eleven, were tested by means of a questionnaire containing a mixture of open-ended and multiple-choice botany questions and systematic group interview methods.

Although the group-interviewing method has some practical strengths, its disadvantages which might affect the internal validity of the research should be taken into account before conducting the research. As regards the disadvantages of group interviews, Morgan (1988) noted that this technique reduces the interviewer's control of the interview situation. Furthermore, he maintained that it is not known if subject

responses represent their individual knowledge since their behaviour is subject to group influence.

However, the outcome of the work indicates that the students from highly dense and variously vegetated school grounds had more knowledge about botany than the students from sparse and less variously vegetated ground. The difference was more pronounced in terms of detailed knowledge about vegetation in the school grounds. Generally, there was a positive correlation between children's direct experience with vegetation and their botanical knowledge.

Russell, et al. (1993) carried out an investigation concerning children's ideas about rocks, soil and weather as part of the Primary Space Project. When children (aged five to eleven) were asked the possibility of rock being transformed into soil, their responses revealed that it was impossible for soil to be formed from rocks. The reason for rejecting the possibility was that whilst a rock is hard, the soil is soft and probably the children had not been told that soil comes into existence as a result of crumbling rocks.

Probably one of the most seminal pieces of work in this area is that undertaken by Harwood and Jackson (1993). They investigated nine to eleven year-old children's conceptions of nine common vernacular physical landscape features which are found within the National Curriculum for primary school geography in England. Nine children were tested to see if they understood everyday vernacular concepts, namely, *beach, sea, river, mountain, hill, ocean, cliff, harbour* and *valley*,

using a variety of open-ended questions, picture recognition, and picture drawing strategies.

Although these techniques seemed very effective in revealing the children's ideas, the sample may be too small to generalise from it. Although the authors acknowledged this deficiency, they believe that the findings are useful for teachers and curriculum developers in terms of the sequence of teaching of common physical landscape features.

The findings point out that there is a positive link between children's direct experience and their conceptual understanding. In fact, the children who had direct experience of the physical landscape features possessed almost twice as much knowledge as children who had not.

Unlike these findings, Ross and Shuell (1993) indicated that an actual experience of an earthquake does not make a big difference to children's ideas. Three schools, located in western New York State and in Utah which experiences different levels of seismic activity, were selected in the United States. Ninety-one children, grades four-six, were assessed through interview technique. The results showed that although 38% of the students from Utah had experienced an earthquake, their knowledge about earthquakes was not greater than that of the students who had had less experience of an earthquake. The reason why the difference was not significant was attributed to the media and classroom instruction. It was concluded that since most children had watched the news on television concerning the Loma Prieta

earthquake and instruction about earthquakes existed in the curriculum, the effect of direct experience was not pronounced.

Wiegand (1993) stressed that children construct their knowledge of the geographical environment from their first-hand experience. He claims that there is a close relationship between children's experience of a river and their perception of a river. Children regard a river as a considerable amount of water that flows along a course in its surroundings.

Similarly, the results of an investigation conducted by Platten (1995a) showed that children could benefit from their first-hand experience. For example, one child who had considerable experience of family holidays in the Lake District, was able to express that streams can begin in mountain areas and flow into rivers which eventually reach to the sea. She also managed to know that the sea was a much bigger volume of water, was salty and much deeper than a lake.

McDonald and Bethel (1996) carried out a comparative study in order to find out the effects of first-hand experience on children's knowledge of marine species and their feeding habits. For the purpose of the research, subjects were randomly selected from the populations of fourth grade students living in coastal and inland areas in Texas. The criteria for choosing each community was that each set of subjects had to have experienced the same informal education opportunities and curriculum and be similar in their ethnic and socio-economic make-up. After this initial selection, using class lists and a table of random numbers, eight students (four males and four females) were selected from both sites.

Since a small sample (n=16) was employed, it is clear that the generalisability of the findings is not reliable. Although the investigators admitted this deficiency, they believe that the findings are still valuable to educators, curriculum developers and future researchers, provided that they are interpreted correctly.

The interview technique was used as a data collecting method to explore each participant's knowledge. During the first stage of the interview, questions which required a verbal response were asked. In the second stage, children were asked to identify pictures representing twenty-five marine organisms that are found in the coastal waters around where they live.

Of the fifty-five organisms only twenty were recognised by four out of sixteen children. The students who lived in the coastal area were more aware of the marine organisms than the students who lived inland. That is to say, the coastal residents identified more marine organisms than the inland residents did. However, the difference is not significant. On average, about fifteen organisms were identified by coastal residents and thirteen organisms were named by inland residents. When we look at this data it can be seen that there is no significant difference between the knowledge of coastal residents and that of inland residents. After seeking information about the sources of knowledge, the reason became apparent. Since the sources of knowledge were media (some relevant programs and advertisements), printed materials (books, encyclopaedias and magazines), classroom-based instruction and school-sponsored field trips, every child had an equal opportunity to learn about

marine organisms. Accordingly, the environmental effects on marine knowledge may not have been evaluated precisely.

On the other hand, it was reported that there was a difference between male and female students in the awareness of marine organisms as a result of first-hand experience, because male students had more direct experience of marine species than their female counterparts. The fact that parents are more protective of girls than boys might be the main reason for this difference. In other words, since girls are seldom allowed to play beyond the safety of the immediate environment, they may not have an opportunity to interact with the marine environment which might be considered a dangerous place for girls. The second reason for the difference might be that boys rather than girls are taken sea-fishing.

Further research by May (1998) led to the refinement of the idea that children's first-hand experience with the immediate environment affects their conceptual understanding. The investigation reveals that children's local environment has a great influence on their perceptions about a river. Although the children had different ideas and misconceptions about the source of a river, most of them had the correct idea about the final destination of a river since they have lived near a major Devon estuary.

To conclude this section, most of the investigations suggest that there is a close correlation between children's direct observation and their conceptual knowledge in physical geography. That is, the existing literature has suggested that

direct experience of the environment is one of the most influential factors in concept acquisition in physical geography.

2.7 Conclusion

The research began with a definition of a concept followed by several theories of learning in cognitive psychology. It has been shown that there is no rigid definition of a concept. The review has also showed that a concept can be classified in various ways: abstract-concrete concepts, technical-vernacular concepts, lower level-higher level concepts and simple-complex concepts. Skinner's stimulus-response theory, Piaget's stage theory, Bruner's stage and cultural theory and Vygotsky's sociohistorical theory are regarded as the most common learning theories.

Skinner argues that learning is achieved by association between stimuli or between stimuli and responses. Piaget suggests that there is a developmental sequence in learning. He describes the developmental stages in levels of thinking, progressing from sensori-motor through pre-operational to concrete operants and formal operants. Bruner's learning theory resembles Piaget's in that he believes in a developmental sequence in concept acquisition. He defines three stages which were *enactive* (learning by doing), *iconic* (dependent on sensory organisation) and *symbolic* (representation in words or language). However, unlike Piaget, he stresses the role of language, communication, social interaction and instruction in the development of knowledge and understanding. Vygotsky, similar to Bruner, believes

that concepts are naturally formed through contact with the social environment. This theory also suggests that language plays an important role in concept learning.

With regard to the factors that influence concept learning in physical geography, the literature shows that the nature of the concept, characteristics of the learner, social class background and first-hand experience with the local environment influence children's conceptual understanding.

Studies (Piaget 1929, Smith and Dougherty 1965, Mcaulay 1966, Sheridan 1968, Lunnon 1969, Klausmeier et al 1974, Matthews 1984, Matthews 1987 and May 1998) concerning characteristics of the learner and their influence on concept acquisition indicate that there is a relationship between children's age, sex and general ability and their conceptual understanding. With regard to the age, older children have more comprehensive understanding of geographical concepts than younger children. As children get older, they increase their geographical knowledge by accessing more geographical information sources. The difference could also be attributable to older children's more advanced cognitive capacity. Concerning the gender, the idea that boys are superior to girls in geographical knowledge has been widely accepted. This difference could be explained by the fact that boys have more chance to investigate their local environment.

Investigations (Milburn 1972, Platten 1995a and Kaminske 1997) related to the nature of the concepts and influence on concept acquisition show that some concepts are easily grasped by children, while others cause problems. One of the most common findings of these studies was that young children find it more difficult to

understand technical, abstract and complex concepts than concrete, vernacular and simple concepts.

However, Milburn's (1972) and Platten's (1995a) investigations also showed that the concept 'valley' caused particular problems for some children. Similarly, Harwood and Jackson (1993) found that children had difficulty in understanding of the concepts 'valley', 'ocean' and 'cliff'. These studies suggest that children might have difficulty with some certain geographical concepts, even if they are concrete and vernacular. Therefore, there is a need for further investigation to identify which concepts are difficult for children and the reasons behind it.

Investigations (Vygotsky 1962, McAulay 1966, Sheridan 1968, Lunnon 1969, Jervis 1984 and Harwood and McShane, 1996) in children's social class background and its influence on concept learning suggests that children's social background plays an important role in their conceptual understanding. Children from higher social class have better knowledge and understanding in geography.

Vygotsky (1962), Gagne (1971) and Bruner (1973) suggest that children's conceptual understanding is closely related to their language development. However, a literature review reveals that little research related to the role of language in concept formation in the context of geography has been carried out. Perhaps, the most seminal investigation in this area was carried out by Milburn (1972). His research reveals that homonyms (words which have two completely different meaning) and homophonic words (words which the sound the same but have different spelling) present particular problems for children.

Considering the lack of research in this field, it may not be surprising to suggest that there is much remain to be investigate. For example, the relationship between children's direct experience of the physical environment and their language development and children's understanding of the close associated terms, such as pool/lake and cliff/mountain are worthwhile investigating.

Studies (Sheridan 1968, Stepans and Kuehn 1985, Harvey 1990, Russell, et al 1993, Harwood and Jackson 1993, Wiegand 1993, Platten 1995a and May 1998) concerning direct experience and its influence on concept acquisition show that there is a positive correlation between the level of conceptual understanding and children's direct experience of the geographical features. That is, direct experience helps children to develop their conceptual understanding in physical geography.

Children's ideas about the formation of the geographical features were investigated by Piaget (1929), Stepans and Kuehn (1985) and Eyres and Garner (1998). Their investigation suggested that children hold alternative conceptions about the origin of the physical phenomenon. Children's chronological age and socio-cultural background were considered the main reasons why they had alternative conceptions. However, the investigations were not focused on whether there is a relationship between children's ideas about the formation of the geographical features and their direct experience of these features. Therefore, there is a need for a further investigation to determine if children's ideas about the origins of the geographical phenomena are influenced by their direct experience.

Chapter Three

Research Methodology

RESEARCH METHODOLOGY

3.1 Introduction

Before starting a detailed discussion of the methodology used in this investigation, a brief explanation concerning the aim of the present study seems essential. In essence, the aim of the study is to explore whether young children's knowledge of physical geographical concepts is affected by their experience of their physical surroundings.

Five different methods (Picture Drawing Method, Interview Method, Picture Recognition Method, Labelling Method and Group Working method) were used in this investigation as a means of collecting the relevant data. These methods were designed in the light of the problem the study was set up to explore. As has been implied, the main characteristic of the methodological approach is its eclectic nature, drawing upon a variety of approaches. That is, the triangulation method, which is described as the combination of two or more different methods in the same research was applied in this investigation. The nature, potential and limitations of these methods will be presented following the explanations relating to sample selection, sample size, sample characteristics and the nature of the concepts selected.

3.2 Sample Selection

In order to understand as far as possible the influences of the environment, it was necessary to select samples from different geographical environments. Therefore, a coastal and lakeside environment in the Black Sea Region in Turkey were selected as research sites. A short description of each place was given in the previous chapter.

3.3 Sample Size

In any quantitative educational research, using the largest sample possible is highly recommended in order to avoid sample bias and standard error (Coolican, 1994; Fife-Schaw, 1995; Gall, et al. 1996). However, it is not possible to employ the largest sample in every case because of the limitations of time, finances, and so forth. Therefore, researchers have developed rules to determine the minimum number of cases needed for different research methods. In correlational research, it is traditional to use a minimum of thirty subjects. In causal-comparative and experimental research, there should be at least fifteen subjects in each group to be compared (Gall, et al, 1996). Using this suggestion as a guide, forty students were selected from each site as a sample.

3.4 Sample Characteristics

For the purpose of this study, eight-year-old children from the second grade were selected to participate (N=80). The main reason for selecting this age group was

to investigate children untutored in selected concepts in order to eliminate the teaching factor. In accordance with the Turkish curriculum, children in Grades One and Two, seven and eight years old respectively, do not have any formal instruction regarding the local and regional environment. In other words, at the time of the assessments, the children in Grades One and Two had not been taught about their physical environment. Therefore, any ideas these pupils had of their local environment would probably be due to personal constructs based upon their own daily experience or the product of informal education. Briefly stated, this age group was chosen in order that the impact of the curriculum upon young children could be eliminated as far as possible.

Many of the previous investigations (Sheridan 1968, Hart 1979 and Matthews 1984) indicate that there is a difference in children's geographical knowledge between boys and girls. Therefore, the samples were equally matched as much as possible with respect to sex so that a sound comparison could be made (Table 3.1).

Table 3.1 The Percentage of the Coastal and the Lakeside Children according to Gender

	Coastal Location		Lakeside Location	
	Frequency	%	Frequency	%
Male	21	52.5%	18	45.0%
Female	19	47.5%	22	55.0%
Total	40	100.0%	40	100.0%

The children in both locations were mixed-ability groups. Since the study was not focused upon the influence of general ability on children's conceptual understanding, the children sampled were not selected according to their mental ability.

Two primary schools, one from the coastal location and the other from the lakeside location, were chosen for the study.

With regard to the coastal school, due to the large number of children in the second grade, the classes had been divided into two groups, Classroom A and Classroom B. All children from the Classroom A (thirty-four) were chosen to participate. In order to complete the sample size, the remaining six children were randomly selected from the Classroom B.

Similar to the coastal school, the classes in the lakeside school had been divided into two groups, Classroom A and Classroom B. In a similar way, all children from the Classroom A (twenty-eight) were chosen and twelve children from Classroom B were randomly selected by the classroom teacher.

3.5 Selection of Concepts

The most common physical geographical features with which the children were familiar were selected from each site: *the sea* and *a river* from the coastal location, and *a lake* and *a river* from the lakeside site. The selection of these concepts were based on the following reason. According to Marsden's classification (1995)

these physical features are vernacular terms since they are common in everyday speech and they are concrete since they can be directly experienced. Investigations in this domain have shown that young children have difficulty understanding technical and abstract concepts, even if they have direct experience of these phenomena. For this reason, vernacular and concrete concepts, which correspond with eight-year-old children's cognitive capacity, were selected in order to avoid this difficulty

3.6 Data Collection

As was stated before, the study intended to collect data using the triangulation method. The main reason for using this was that it collects data through different avenues. This method allows the results to be compared so as to determine whether the research findings are valid and reliable. For example, if the outcomes of an interview correspond to those of picture recognition and picture drawing tests of the same concept, it reinforces the research results. The second reason for applying a multimethod approach was that it provides rich data. The richness of the data refers to the acquisition of data about subjects that shows detailed outcomes rather than the acquisition of a large mass of data.

As well as the selection of a variety of appropriate methods, the order in which they were employed is important because children's knowledge about the feature can be positively or negatively affected if the methods are carried out in the wrong order. For example, if a picture recognition method is followed by a picture

drawing method, it would then give some clue to the children about the features of the phenomena which could affect their drawings. Therefore, after the pilot study, the methods were used in the following sequence: picture drawing method, interview method, picture recognition method, labelling method and group working method.

3.6.1 The Pilot Study

Before embarking on the data collection a pilot survey was carried out with a small group of children who had similar characteristics to those of the children who were to be used in the main study, in order to try out the methods, material, equipment, etc. The aim of this survey was:

(a) to determine what kind of difficulties could arise during the interview

(b) to determine if all the questions and instructions were clear

(c) to determine if the photographs chosen were meaningful

(d) to determine which language level should be used

(e) to determine how much time should be allocated for each method

3.6.2 Picture Drawing Test

Schibeci and Sorensen (1983) stress that data collection methods that do not rely on the child being able to verbalise are more appropriate for assessing the perceptions of young children. Therefore, drawing might be considered to enable children to express their ideas more easily and freely than spoken and written

language. In other words, it provides them with a flexible and specific means to communicate.

However, despite its advantages mentioned above, it is necessary to bear in mind some critical questions to find out to what extent this method is reliable: *Is there any link between children's drawing and their physical environment, psychological conditions, home and cultural background, and mental age*? *Can children make the images they want; that is, does drawing require special skill?* Arising from these is the final question; *How far do children's drawings represent their internal views of the object?*

Some studies have shown that there is a strong relationship between children's drawing and painting and their psychological conditions. Alschuler and Hattwick (1969) and Golomb (1992) consider colour as the ideal means through which young children can directly express their feelings, emotions, conflicts, and difficulties. These studies clearly suggest that children's drawings and paintings are influenced by their psychological conditions. On the other hand, Kellogg (1979) implied that there is no clear evidence that there is a link between children's emotional problems and their drawings.

There is a general agreement that children's drawing is influenced by their home background before going to school. Kellogg (1970) pointed out that children's parents, older children in the family, relatives and friends can affect children's drawings. Although a few children are instructed in how to draw a picture by their parents, most of them are influenced indirectly, through being provided with drawing

materials, colouring books, picture books, magazine art, and so on. In agreement with this idea, Horovitc et al. (1973) and Court (1992) found that children's drawing is closely related to their socio-cultural situation.

Freeman (1980) argued that children's drawing does not reveal their internal representation of the object. He maintained that children's knowledge about the object is more accurate and detailed than their drawings reveal. In accordance with Freeman, and drawing upon the implications of the previous studies, it might be concluded that children's drawings might not be fully representative of their understanding of the features. Thus, the analysis of the drawings was supplemented by the other methods described below.

Each drawing session began with a warm-up exercise in which the children were provided with a sheet of A4 Paper, a set of coloured pencils, a pencil, and an eraser. They were seated at separate tables so that they could not see each other's work. After that, they were told to draw a picture of *the sea*. In addition, they were told this would not be marked, so that they could feel free to draw anything. No advice was given about how the pictures should be composed and the children were free to add further details if they so wished. Even if the children made a mistake or drew a poor picture, they were not told to correct it. When a child asked for help before or during the process of drawing, the instruction was simply repeated. When he/she asked if the picture he/she had been drawing was acceptable, constructive responses such as, *very interesting, good work, nice colours* and *a nice sketch* were made to encourage him/her to draw.

Since there was no time limitation on carrying out the assignment, each session took approximately an hour. Following this session, the children were asked to draw the other two features, *a lake* and *a river*, on subsequent days by using the same procedure and instruction.

In order to prevent the children from mental stress and discomfort, after they were given the drawing instructions they were told: *Anyone who does not want to draw the picture does not have to do so. If you wish you can go out or do something else.* Despite this, the participation in the drawing activities was significant. The results showed that thirty-eight coastal children and thirty-nine of their lakeside peers took part in the activity. With regard to the drawing of a lake, thirty nine coastal and all the lakeside children participated in the activity. The river drawing task was completed by all children from both sites.

3.6.3 Interviews Method

A number of studies have been carried out in order to investigate children's knowledge concerning the physical phenomena. Much of this work involved using the interview technique because it was believed that this technique allows children's ideas to be revealed more fully than the other techniques.

Stephans and Kuehn (1985) state that:

> What our study seemed to reveal about methodology was interesting in itself. The interview technique, with its use of follow-up questions, seemed to be helpful in revealing a great deal about a child's true understanding of a concept. (p 47)

In addition, Klein (1982) notes that:

> This method elicits more than a superficial response. It is possible to believe children have sound understanding of a concept but further questioning may reveal that some children do not understand the concept or have a limited or incorrect view. (P.96)

A structured interview consisting of open-ended questions was employed in this study. Wiegand (1996) identified three kinds of items, which are used in the construction of a structured interview schedules: fixed alternative items, open-ended items and scale items. One reason for using structured, open-ended questions was that, as he suggested, it gives the interviewer an opportunity to elucidate misunderstanding. A second reason for using structured, open-ended questions was that it allows a comparison of children's ideas collected from different places. In particular, this type of interview is quite acceptable in geography education, where comparative data are obtained from a number of locations (Wiegand, 1996). Therefore, in order that a comparison between the coastal and the lakeside children's ideas could be made, it was necessary to have a structured interview schedule.

An interview guide which indicated the outline of the topics and their sequence was used. That is, each child was asked the same questions in the same order according to this guide. The questions asked of the children will be explained in the subsequent sections. The reason why the interview guide was used was to ensure that the same information was obtained from all pupils. The guide was prepared as a draft and it was then reformed during the course of the pilot study.

3.6.3.1 The Nature of the Interview Questions

Each interview question was prepared in accordance with its relevance to the research purposes and the children's cognitive capacity. Concerning the former, the questions were designed in order to reveal children's knowledge about the phenomena of *the sea, lakes*, and *rivers*. About the latter, they were simple and brief, because eight-year-old children may have difficulty in understanding of scientific and difficult questions.

3.6.3.2 Administration Procedure

The interview was administered individually to all children in a quiet and familiar room in their school. All sessions were tape-recorded and transcribed after the interview. To avoid the problem of participants being reluctant to talk to a stranger, the interviewer had spent some time with the children by attending classroom sessions before the interviews were carried out. In addition, they were told that the interview was not a test, in order to dispel their anxiety.

During the course of the interview, when there was a disturbance, the interview was restarted at the beginning of the last question used. When the child gave a quiet or distorted response, the response was restated by the interviewer to check the meaning, and the child's responses observed, usually a nod or shake of the head, in order to avoid misunderstanding. Another notable feature of the interview was that the children were given time to think, when they could not provide an immediate response. If they could not provide a response after a suitable pause, an

encouraging comment from the researcher was made before moving on to the next question.

3.6.3.3 The Interview Format

The interviews had distinct sections, each aiming to focus upon a particular aspect of the concept of *the sea, a lake* and *a river.* Each section included a list of questions which had been formulated to investigate certain areas of understanding.

A. Information on the Children's Socio-economic Backgrounds and their Daily Activities

Information on the children's socio-economic background and their daily activities were explored in the first stage of the interview. The following questions were some of the more widely used examples aimed at producing results about children's socio-economic backgrounds: *Where do you live? What does your father do? What does your mother do*? *How many brothers and sisters do you have?* Concerning children's daily activities, the following questions were asked: *What do you do after you leave the school*? *What do you do in the holidays? What do you do in your spare time? Do you watch TV*? *What kind of TV programmes do you watch*? *Do you read a newspaper or magazine?.*

School records were also used to confirm the children's responses and to obtain more detailed data.

B. Information on the Sources of the Children's Knowledge about the Concepts

In order to obtain information about the sources of the children's knowledge, each child was asked the questions: *Have you ever seen it* [the name of the concept] *before*? If the answer was *Yes*, the following question was asked: *Where did you see it?* However, if the child's response was *No* he/she was asked *Have you heard it before?* The questions *Have you been to a coastal place*? *Have you been to the sea*? *Have you been to the riverside*? *Have you been to the lakeside*? were also asked to provide further information.

C. The Children's First Thoughts of the Concepts

A criticism of Milburn's (1972) study made by Platten (1995a) was that Milburn underestimated the children's real understanding as he asked them for a simple definition of a concept. The analysis of the present pilot study also revealed that a substantial number of children were not able to give a response when they were asked a definition of the geographical features Therefore, it was concluded that it is likely that children's real understanding can be underestimated by asking for a simple definition.. For this reason, the questions *Could you tell me what it* [the name of the feature] *looks like? What can you tell me about it* [the name of the feature]? and *What do you think of when I say the word* [the name of the feature]? were asked to provide information about the children's first thought of the features.

D. The Children's Ideas about the Source of the Water in the Sea, a Lake and a River

The children were asked to explain the source of water in the sea, a lake, and river and where a river ends. The following questions were asked: *Do you know where its* [the name of the phenomena] *water comes from*? *Where does it* [the name of the phenomena] *receive its water from*? and *Where does it* [the name of the phenomena] *supply its water to*?

Regarding the destination of river water, it was of interest to elicit ideas about the final destination of a river. The questions *Where does a river end up*? and *What is the destination of a river?* were asked to see if the children knew a river ends up in the sea.

E. The Children's Ideas about the Formation of the Sea, a Lake and a River

Although the formation of *the sea*, *a lake*, and *a river* are not phenomena which can directly be observed, it was interesting to see if the children were capable of theorising and attempting to provide an explanation of the formation of the features. Another reason for the inclusion of this aspect was to explore whether children's knowledge of the origins of the natural phenomena was affected by their physical surroundings. Despite the fact that there are some investigations in this domain such as Piaget (1929), Smith (1965), Dolgin and Brend (1984), Stepans and Kuehn (1985) and Gelman and Kremer (1991), none of them has focused on the

relationship between children's explanations about the origin of a phenomenon and first-hand experience of it. Therefore, the children's ideas about the origin of the concepts were included in the research to contribute to filling the gap.

The following questions were included to find whether children's responses would differ from each other because of their different environments: *Do you know how it* [the name of the phenomena] *begins*? and *Do you know how it* [the name of the phenomena] *was formed?* If the children were not able to give a response to these questions, they were asked: *Was it* [the name of the phenomena] *formed by itself or did someone make it*? to encourage them to reveal their ideas, as the pilot study showed that the former questions were too broad to be answered by some children.

F. The Children's Ideas about the Living Creatures in the Sea, a Lake and a River

The final part of the interview focused on the living beings in the sea, a lake, and a river. The question *Is there a living being in it* [the name of the concept]? *Do you think anything would live in it* [the name of the concept]?, *Could you tell me what it is?* and so on, were asked to provide information about the children's factual knowledge of living beings found in the sea, a lake and a river. The children were prompted by such questions as *What else?* and *Is there anything else in it?* In order to obtain more insight into their ideas.

3.6.4 Picture Recognition Test

Researches in the domain of concept learning in geography have given evidence that there may be a gap between what children think and how they respond during interviews because of the poor level of language development. Lunnon (1969) found that some children did better in the tests involving discrimination between pictorial representations of exemplars and non-exemplars of a concept than in the tests requiring verbal responses. Nash (1983) revealed a similar result after assessing children's understanding about a river and its features. However, Harwood and Jackson (1993) provided a slightly different outcome when they assessed children's understanding of some physical landscape concepts, namely, *hill, mountain, beach, river, valley, harbour, ocean, sea,* and *cliff.* Children were showed sixteen pictures, that is, two different pictures of each of the eight concepts. Their responses were categorised into three groups in terms of the level of understanding rather than the number of correct identifications and compared with the responses provided by the interviews. The outcome indicated that 51% of the children showed full understanding in the picture identification tests compared with 64% in the oral test. The difference between this and the previous researches can be explained by the fact that the analysing method used was not similar to those the former researchers had used. This analysis revealed the stereotypical images of landscape features, which children sometimes carry in their heads.

What is common in these investigations is that the result of the verbal interview, in some cases, does not correspond with the result of the picture

recognition tests. That is, in picture recognition tests, children might show their real understanding, which they could not reveal in the verbal tests. Putting it another way, it is hard to determine children's ideas if only the verbal interview method is used. Young children may have difficulty expressing their view verbally because of their communication problems and lack of geographical vocabulary. For this reason, picture recognition tests were included so as to offer to all the children, irrespective of their language capability, opportunities of revealing their ideas about the features.

The children were presented with six photographs: two different pictures of each of the three physical landscape features (Appendix A). For each of the pictures, the children were asked a number of sets of questions to explore three areas: acceptance or rejection of the example, the reason for the acceptance or rejection and their capacity to differentiate between the features.

Concerning the first area, after giving them an opportunity to look at all the pictures, the children were asked *What do you see in this picture?* and *Can you tell me the* [name of the concept] *in this picture?* If he or she managed to give the correct answer, the second set of questions was asked to explore the second area. These were *How do you know*? or *What tells you that it is* [the name of the feature given by the child]? In order to explore the third area, the second sets of questions were moved to detect if children were able to recognise the similarities and differences between these concepts. Children's ability in this area was explored in response to the question: *Could you tell me, if it had been* [the name of the feature which the child had not

talked about] *what would it be like?* For instance, if the child had said *it is a lake*, the question would be *If it had it been the sea, what would it be like*?

3.6.5 Labelling Method

Along with the other tests which were used in this investigation, the labelling method was also carried out to provide further information about the children's knowledge of the selected features. The main purpose of this method was to uncover whether the children were able to recognise the most common geomorphologic features related to the selected concepts in the photographs. In order to obtain this attainment target, each child was individually tested once on the picture of *the sea, a lake*, and *a river* respectively. These pictures were specially selected in accordance with the aim of the method. That is, each picture had to show the most common features of the phenomenon.

The name of the features which were found in the pictures was printed in upper case with a black marker pen on a 5 cm x 2.5 cm white rectangular piece of cardboard. The cards for the picture of the sea carried the words *the sea, a cliff, a beach, wave,* and *stones*; for the picture of the lake, these were *a lake, hill,* and *clouds*; and for the picture of the river, *a river, a cliff, hill* and *stones*. In addition to these cards, other cards were printed with words which did not relate to the picture to test whether the children would reject them.

In the first phase, the picture of the sea and the cards printed for only this picture were presented to the child and he or she was asked to read each word to

make sure he/she had no difficulty in reading. After establishing rapport, he/she was instructed *Now I am going to let you play a matching game. I would like you to find the word that goes with the picture and put it on the picture. If you cannot find it in the picture please leave it.* A sample demonstration was given if the child did not understand.

If the child was unable to put the correct card on the picture, he or she was not told if her response was wrong. A response was recorded as correct if the child's response corresponded with the feature in the picture. Any mismatch between the labelled card and the feature was recorded as an error. After completing the task, the child was asked questions about her work in order to make sure she had matched the cards on purpose. Responses were also recorded as correct if the child corrected an error during this review. Examples of the children's responses are provided in Appendix B.

3.6.6 Group Working Method

A group working method was developed to help remind the child of the information that he/she already knew. Since this method had not been used before, careful considerations had to be worked into its design. After its initial design, it was tested during the pilot study. Aspects of the potential and limitations of the method were identified during the course of the pilot study. The potential and limitations of this technique included the following.

The pilot study showed that this method offered distinctive advantages for collection of rich, in-depth data. Firstly, the method provided data much more quickly than would be the case if each child were interviewed separately. Secondly, the method produced a wide range of both qualitative and quantitative data. Thirdly, the method allowed children to react and build on the responses of other group members. The synergistic effect of the group setting may have resulted in the production of data or ideas that might not have been uncovered by the other methods (e.g. individual interviews, picture recognition, and picture drawing).

Although this method was a valuable research tool and offered a number of advantages, it did have its limitations. The results obtained by this method could have been biased because of a very dominant or opinionated member. In other words, introverted children could have been hesitant to talk.

The group working method involved groups of three children as well as the investigator. The group was specifically designed to bring together pupils who knew each other very well. The reason for selecting the children who were close friends was to encourage them to talk with each other, because the degree of familiarity generally determines individuals' behaviour in a group. Highly compatible groups perform their tasks more efficiently than less compatible groups because children will talk more easily in the company of friends. Another criterion for selecting group members was the child's ability to participate with others, because if a child became disruptive in the group this could impede the success of the group. Using these two criteria three children were selected by the classroom teacher.

It was considered that the physical characteristics of the room in which the experiment took place would influence group interaction. Therefore, a quiet, medium-sized room was allocated by the head teacher. All the objects which could distract the children were removed from the room. In addition, the furniture within the room was rearranged in order to determine the children's sitting position. The children were sat in the chairs around a table in a circle to see one another easily.

A number of descriptive words related to the features were selected and categorised into three groups: (a) natural features of the sea water, lake water, and river water (b) the nature of the coastal, lakeside, and riverside environment (c) living beings in the sea, a lake and a river.

With respect to the first group, the words *Blue Water, White Water, Muddy Water, Dirty Water, Clean Water, Foam, Flowing Water, Still Water, Fast-flowing Water, Slow-flowing Water, Salty Water, Deep Water, Shallow Water, Much Water, Less Water, Waves* and *Tides* were included the list. Regarding the second group, *an Island, a Cliff, a Coast, a Beach, a Bay, an Inlet, an Estuary, Rocks, Stones, Pebbles, Waterfalls, a Valley, Mountains, Hills* and *Slopes*, were introduced into the list. Concerning the last group, *Fish, a Mussel, a Crab, a Jellyfish, a Grass snake, Moss, Sea Grass, a Frog, a Beetle, a Seagull* and *a Duck* were added to the list.

As in the case of the labelling method, the words listed above were printed in upper case letters with a black marker pen on a small piece of white rectangular cardboard. In addition, three white A3 sheets were placed on the table, on each of which was written the name of the features, *the sea, a lake*, and *a river*.

Three children selected by the classroom teacher were sat down around a table and were instructed in how to carry out the activity. Each session was divided into nine phases, starting with natural features of the seawater. Firstly, all the printed cards about the natural features of the seawater and the A3 paper were presented to the children, who were then asked to read the cards for about one minute. Following this activity, instructions were stated in clear, simple language and illustrations were provided. Children were instructed as follows: *All these words written on these cards are to do with the water. Some of them describe the seawater and some of them do not. I would like all of you to put all the words which describe the seawater on this paper. If it the word is not about seawater or you do not know its meaning please leave it. Feel free to talk about it with each other and agree among yourselves.* When a child who did not agree with the others asked the researcher for help or to confirm his answer, he was told *It is for you to decide.* Even if one of them did not agree with the other two, he was allowed to put the words on the paper.

The children were encouraged to enjoy the group activities and regard them as fun. However, they were urged to say if they were unwilling to participate.

To gain a good appreciation of the children's knowledge of the features, after finishing the activities they were asked to explain the reason why they classified the words as they did. The responses were recorded taking into account how many of them agreed on the word they put down. The discussion was also tape-recorded from the beginning to the end of the session. Each session took between 40 and 60 minutes.

The remaining eight phases, (covering the natural features of lakewater and river water, the natural environment of the sea, lake, and river, living beings in the sea, a lake, and river) were performed by using the same instructions and administration. An example which shows how the method works is provided in Appendix C.

3.7 Conclusion

The investigation was carried out in two schools one of which was located in a coastal place and the other was situated in a lakeside area. Forty children from each school (N=80) were tested through a range of methods, namely, picture drawing method, interview method, picture recognition method, labelling method and group working method. The main reason why multiple research techniques were used was to yield sufficient information about the children's ideas.

Chapter Four

Results and Discussion

RESULTS AND DISCUSSION

4.1 Introduction

This chapter has been divided into five sections. The first section investigates the children's first thoughts on the concepts, the sea, a lake and a river. The second section focuses on the children's ideas about the definitive and distinctive features of the concepts. The third section explores children's ideas about the sources of water of sea, lake river and the final destination of a river. The next section examines whether the children's physical environment influenced their ideas about the formation of the sea, a lake and a river. The final section is concerned with the children's awareness of living creatures in the sea, a lake and a river. Before presenting these sections, the children's socio-economic backgrounds and their sources of knowledge will be summarised respectively.

The children's responses were scrutinised and categorised so that comparisons could be made. The choice of the categories is not arbitrary, it is grounded in the data content of the responses. Frequency tables and bar charts were constructed based on these categories. Detailed explanations about the categorisation will be given at the beginning of the appropriate section.

In most cases, the children's responses were categorised as 'correct', 'wrong' and 'no idea'. The children were put into the 'correct' category, if they could give an accurate answer to the questions. However, they were placed in the 'wrong' category,

if they were unable to provide an accurate response. They were included in the 'no idea' category, if they showed no indication of understanding the concept concerned.

In some cases, a chi-square test has been used to justify whether there is a significant difference between the children's responses.

Since the children were not capable of making a decision about confidentiality because of their age, personal information about them is not revealed in this study. For this reason, each child is identified by a randomly selected number.

4.2 The Children's Socio-economic Backgrounds and Their Daily Activities

Children's socio-economic background and their outdoor activities are important factors in the acquisition of environmental knowledge (Matthews 1992). Taking into account this assertion, it is necessary to begin the chapter with a summary of the children's socio-economic backgrounds and their daily activities outside school.

The coastal children lived in a residential rural area with a population of approximately 578 according to the 1990 census of population. The data obtained via the interviews with the children and the school records reveal that most of the children's parents were involved in trading, agriculture and fishing. The data also showed that about 15% of the children's families were unemployed. However, the population of the lakeside location was greater than the coastal place with a

population of about 2,797 according to the 1990 census. Logging, agriculture and trade were the main sources of income for the children's families. Unemployment was slightly higher than at the coastal site.

According to the data, one child from the coastal site was born in Germany. The child had moved to the area two years before she took part in the investigation. The rest of the children had been resident in the area all their lives. With regard to the lakeside site, with the exception of two participants, all children sampled had lived there all their lives. Of those children who had lived outside the village, one had lived in Saudi Arabia for two years as her father worked there and the other lived in a city, located in central Anatolia, where her father was employed as a civil servant.

The interview revealed that there was little variation in the activities undertaken by the children of both sites, on weekdays and at weekends. All children spent five hours a day at school. When they returned home, they met with their friends and played in their immediate environment. In the evenings, they spent their time watching television and doing homework. The children's spatial activity range at weekends was greater than on weekdays. Since they had more free time, they expanded their activity range up to two miles from their home with the permission of their parents. For example, one child said *I sometimes go to Malbet to visit my friends* (Malbet is a village about 1.5 miles away from the village where the child lived) (Pupil 21, Lakeside Location).

In conclusion, no clear difference was apparent between the coastal and lakeside children in terms of their socio-economic background and daily activities.

Therefore, it would be suggested that these two variables influenced the children's understanding of the concepts selected, equally in both groups.

4.3 The Sources of the Children's Knowledge about the Concepts

As has been indicated in Chapter 2, the literature showed that children's direct experience is one of the most important sources of knowledge about their immediate environment. However, with regard to the knowledge of the distant environment, Bale (1987), Wiegand (1992) and Palmer (1994) have suggested that children gain a considerable knowledge about distant places through vicarious experience, such as television, books, films and pictures.

This section investigates whether the children sampled for the investigation acquired knowledge about the concepts selected via direct experience or vicarious experience.

The results of the interview showed that the coastal children might have gained much of their knowledge of the sea and a river through direct observation. The following are a few examples of the children's sources of knowledge about the features: *I have seen it*, *I have been there*, *There is one near my home*, *There is one just there*, and so on. Some of the children used their own personal experience throughout the interview. The following discussion was typical:

E: *Is there a living being in the sea?*

C: *Yes. There is something which is white and soft* [jellyfish].

E: *Have you seen it?*

C: *Yes. I saw it when I was in the sea. When it touches your body, you get red. I narrowly escaped from it.*

(Pupil 20, Coastal Location).

Concerning the children's source of knowledge of a lake, over half of them appeared to possess knowledge related to a lake through vicarious experience. The majority of these children said that they had seen one on television. For example, one child stated *I saw it on television. There were two people. They were running away. There was no water around. Eventually, they arrived at a lake* (Pupil 33, Coastal Location). Some of the children received information about a lake by hearing about their peers' and parents' experiences. For example, one child said *I have not been to there, but one of my friends told me that...* (Pupil 37, Coastal Location). Another source of knowledge appeared to be printed materials, such as photographs, magazines and newspapers. However, very few children mentioned about these resources as a source of information.

Over a quarter of the whole sample claimed that they had seen a lake near the place where they lived. However, the lakes that the children mentioned were checked in the field and it was discovered that they were pools rather than lakes. This response category might be considered as an indication that they confused a lake with a pool due to misunderstanding of the concepts. Detailed explanations about such confusion will be provided in the forthcoming sections.

Finally, the interview revealed that one child had had a first-hand experience of a lake. She explained that her parents had taken her to a place where there was a lake. Probing questions revealed that the child had been taken to the place chosen as the contrasting sample for the investigation.

Concerning the lakeside children's origin of knowledge, direct experience appeared to be the most important source of information about a lake and a river. The majority of the children stated that they had seen a lake and a river in their local environment. The most common responses were *It is there*, *There is one down there, I have seen it*, and so forth. However, the children's knowledge of the sea came primarily through media sources, such as television and photographs. Another source of information that was found to be of importance to some of the participants was hearing about it from adults. For example; one child said that *my older brother goes there to swim* (Pupil 32, Lakeside Location).

In order to understand whether the children had been to a coastal place, the questions *Have you ever been to Of ?* (Of is a town located on the seacoast and is the only access to the coast for the lakeside residents), *Have you been to a coastal place?* and *Have you been to the sea?* were asked. The questions revealed that there were three children who had been to the town. One of them said that he did not remember the sea, although he had been there. The following discussion took place:

E: *Have you been to the sea?*

C: *No.*

E: *Have you been to Of?*

C: *Yes.*

E: *When was it?*

C: *Two years ago.*

E: *Did you see the sea?*

C: *No, I did not.*

(Pupil 1, Lakeside Location).

Analysing the results of the interview showed that ICT were not used by both groups of children. Although the schools had computers, they were located in the head's office, which means that children had very limited access to them. As a result, computer technology were not used as a learning resource.

In summary, the children from both sites obtained information about the concepts from a number of different sources. All of the children gained information about the concepts which existed in their immediate environment through direct experience. On the other hand, information about the concepts which were in the distant environment was obtained via vicarious experiences.

4.4 The Children's First Thoughts of the Concepts

Information about the children's first thoughts of the concepts were obtained from the main body of the interview. Each child was asked *Could you tell me what it*

[the name of the feature] *looks like?, What can you tell me about it* [the name of the feature]?, and *What do you think of when I say the word* [the name of the feature]? to elicit their first thoughts of the concepts. The responses obtained from these questions were categorised according to the notions that each child revealed.

4.4.1 The Children's First Thoughts of the Sea

Table 4.1 indicates the nature of the children's first thoughts of the sea. Examination of the data revealed that there were some similarities and differences in the content and the frequency of the children's responses.

Table 4.1 The Children's First Thoughts of the Sea

	Coastal Location		Lakeside Location	
	Frequency	%	Frequency	%
No idea	15	37.5%	22	55.0%
It is blue	7	17.5%	6	15.0%
There are fish in it	5	12.5%	3	7.5%
People swim in it	5	12.5%		
It is salty	3	7.5%		
It has got waves	3	7.5%		
It is white	2	5.0%		
It is big			7	17.5%
It is wide			2	5.0%
Total	40	100.0%	40	100.0%

According to the table, fifteen coastal children (37.5%) and twenty-two lakeside children (55.0%) could not offer any response to the questions aimed at

finding out their first thoughts. The remaining pupils provided a variety of descriptive words.

Concerning the coastal children's responses, seven children (17.5%) regarded the colour of the sea as its most important feature, stating that *it is blue*. Five children (12.5%) said that *fish live in it*. Another five of them thought that *people swim in it*. Three of them (7.5%) considered that *it is salty*. The same proportion claimed that *it has waves*. The remaining two children (5.0%) thought *that it is white*.

Regarding the lakeside children's responses, the most frequently suggested feature of the sea was that *it is big*, with a frequency of 17.5%. The second largest response category was offered by six children (15%). This was the suggestion that *the sea is blue*. Three children (5.0%) thought that *there are fish in it*. The remaining two children suggested that *it is wide*

These results show that there were some differences and similarities between the children's ideas.

The first difference was that although some of the coastal children mentioned the saltiness of sea water, none of the lakeside children talked about it. This result is supported by the results obtained from the group working method. The method revealed that while thirty-eight coastal children (95.0%) associated salty water with the sea, only four lakeside children (10%) had the same idea.

The reason why coastal children were more successful than their lakeside peers might be explained by considering the concept of saltiness itself. It is the nature of the concept that it can only be understood through the human sense of taste. For

this reason, it is necessary to experience sea water directly in order to understand that it is salty. Since the lakeside children did not have an opportunity to experience the sea directly, it was not surprising that they did not mention that sea water is salty.

Platten (1995b) investigated seven–year-old children's ideas about human and physical geography concepts and found that most of the children appreciated that sea water is salty. However, since the investigation did not specify whether the children had direct experience of sea water, it is difficult to compare the results with those of our study. If they had had first-hand experience of the sea, it could safely be suggested that their ideas were consistent with those of the coastal children. However, if they had not had direct experience of the sea, the findings of her study would differ from ours, since most of the lakeside children failed to know that sea water is salty.

The second difference was that while a small number of coastal children mentioned waves, none of the lakeside children could offer a similar response. This difference would suggest that the children who had direct experience of the sea were able to associate waves with the sea. With the help of the results obtained from the labelling and group working methods, detailed explanations of the children's understanding of waves will be presented in the subsequent sections.

The third difference was that although some of the coastal children mentioned that *people swim in it*, none of the lakeside children talked about this. Since the coastal children have an opportunity to observe swimming activities on the beach and some of them might have had swimming experience in the sea, they might have associated this activity with the sea.

There were some similarities, however, in the children's responses: Both groups of children regarded the sea as *blue* and as a phenomena which *fish live in.* As the table shows, one of the most prevalent responses given by both groups of children was that *it is blue.* That is, the colour of the sea is considered one of the most important and striking features by both coastal and lakeside children.

A few children with direct experience of the sea had a misperception about its colour, saying that *it is white.* This seemed to relate to the nature of strong waves which sometimes make the sea white. On the other hand, the children who had no or limited experience of the sea confused it with a lake, expressing that *it looks like a lake.*

4.4.2 The Children's First Thoughts of a Lake

The children's responses about their first thoughts of a lake are condensed in Table 4.2.

The table indicates that eleven coastal children (27.5%) and nine lakeside children (22.5%) were not able to express their ideas about the most important and striking features of a lake. The rest of them provided various responses.

Table 4.2 The Children's First Thoughts of a Lake

	Coastal Location		Lakeside Location	
	Frequency	%	Frequency	%
No idea	11	27.5%	9	22.5%
It is deep	6	15.0%	9	22.5%
It is blue	4	10.0%	10	25.0%
It is marshy	4	10.0%	3	7.5%
It is big	4	10.0%	2	5.0%
There is a monster in it	5	12.5%		
There are frogs in it	4	10.0%		
It is water	2	5.0%		
It is muddy			4	10.0%
There are ducks on it			3	7.5%
Total	40	100.0%	40	100.0%

Concerning the coastal children's ideas, the most common response, that *a lake is deep* was given by 15% of the whole population. The second most common response was that *there is a monster in it.* This response was given by five children (12.5%). The responses *It is blue*, *It is marshy*, *It is big*, and *There are frogs in it* were given by sixteen children, each response category being shared by four children (10.0%). The remaining two children (5.0%) stated that *it is water.*

With regard to the lakeside children's ideas, its colour was regarded as its most striking feature by ten children (25.0%). They stated that *it is blue.* Nine of them (22.5%) thought that *it is deep.* Four of them (10.0%) believed that *lake water is muddy.* Three of them (7.5%) said that *it is marshy.* The same proportion considered that *ducks live in it.* The remaining two children (5.0%) indicated that *it is big.*

The results indicate that there were some differences between the coastal and lakeside children's ideas about a lake.

A comparison of the responses might suggest that the media exerted more influence upon the coastal children's understanding of a lake than it did on their lakeside counterparts. While the coastal children had the idea that there was a monster in a lake, none of the lakeside children mentioned it. This difference might be a result of the influence of the media, as there was a rumour in the media that there was a monster in Lake Van six months before the interview took place. It was likely that the children's images of a lake may have been influenced by this coverage. Therefore, when they were asked questions about a lake, their attention might have been called to its most striking feature which for them was the existence of a monster.

On the other hand, the data shows that none of the lakeside children mentioned a monster although they were exposed to the same media. This may be due to the fact that the other features of a lake that the children experienced became more important in their minds and thus, the fantasy that a monster existed in a lake may not have been in the forefront of their minds.

However, it should be noted that the questions related to the children's first thoughts were only designed to reveal what was in the forefront of the children's minds about the concepts. Therefore, no firm conclusion can be drawn using the results obtained from the answers in response to the questions related to the children's first thoughts. More explanations will be given when presenting the results obtained from direct questions about the children's ideas about the living beings in a lake.

A second difference between the children's responses was that although some of the lakeside children considered a lake as *muddy*, none of the coastal children offered a similar response. To explain the reason for this difference, it is necessary to provide some information about the lake water that the children experienced. Geographically, the area is located in the upper course of a river. The course is steep and the river is fast flowing, wearing away the rocks and the soil. The erosion becomes more dramatic when the river runoff volume increases as a result of rainfalls and snow melting. In the period in which the investigation was carried out, the river water sometimes turned a muddy colour because of the snow melting and the rainfalls. Since the river flows into the lake, the lake water also became dull and brownish. Thus, the change in the colour of the lake water seemed to influence the children's perception. Although they may have known that the lake water was not muddy all the time, the current state of the lake water may have become the most important, striking feature for them.

A third difference was related to the frequency of the responses given by the children: while 25% of the lakeside children thought that *a lake is blue,* only 10% of their coastal counterparts had the same idea. This difference might be due to the fact that the colour of a lake becomes one of the most important, striking features because of the high frequency of direct experience.

Analyses of the pattern of responses also show that the children's perception of living beings in a lake was related closely to their local experience. Some coastal and lakeside children mentioned different creatures: whilst the coastal children

thought that *frogs live in a lake*, the lakeside children claimed that *ducks live in it.* The coastal children's responses indicate that these children might have confused a lake with a pool. As was seen in the previous section, a pool was labelled as a lake by some of the coastal children. Since they were familiar with a pool, they knew that frogs existed there. With regard to the lakeside children's responses, the existence of ducks in the lake enabled the children to observe them constantly. Thus, the ducks that they had seen in the lake might have stimulated their ideas when they were reminded of a lake.

4.4.3 The Children's First Thoughts of a River

Table 4.3 summarises the children's views in response to the questions about their first thoughts of a river.

Table 4.3 The Children's First Thoughts of a River

	Coastal Location		Lakeside Location	
	Frequency	%	Frequency	%
No idea	12	30.0%	14	35.0%
It flows	8	20.0%	6	15.0%
It is white	4	10.0%	8	20.0%
There are fish in it	4	10.0%	4	10.0%
It is muddy	4	10.0%	3	7.5%
There are stones in it	3	7.5%	4	10.0%
There is a bridge on it	3	7.5%	1	5.0%
It is big	2	5.0%		
Total	40	100.0%	40	100.0%

As the table indicates, eleven children from the coastal location (30.0%) and fifteen children from the lakeside area (35.0%) were not able to provide a response to the questions. The rest of the children from both sites gave similar responses with different frequency.

With regard to the coastal children's first thoughts of a river, nine children (20.0%) had the idea that *a river flows*. Four children's attention was focused on the colour of a river, saying that *it is white*. This response group accounts for 10% of the whole sample. Another four children said that *fish live in it.* Again, the same proportion indicated that *it is muddy.* A smaller proportion of the children (7.5%) thought that *there are stones in it.* The remaining two responses, *There is a bridge on it* and *It is big,* were given by three (7.5%) and two children (5.0%) children respectively.

Concerning the lakeside children's first thoughts of a river, eight of them (20.0%) held the idea that *a river is white.* Six of them (15.0%) expressed the idea that *a river flows.* Four children (10.0%) stated that *fish live in it.* Another four children thought that *there are stones in it.* Three of them (7.5%) thought that *it is muddy.* The remaining one child (5.0%) talked about *a bridge on a river.*

The results revealed that there was no clear difference in the pattern of the children's responses. However, there was a difference in the frequency of their responses. The main difference was that the proportion of the lakeside children who said that *it is white* was almost twice that of the coastal children. This disparity seems to be related to the nature of the river water the children experienced. As was

mentioned before, the river beside which the lakeside children lived flows swiftly. Therefore, the river water becomes white because of rapids. On the other hand, the river that the coastal children experienced was not as fast flowing as the river in the lakeside area. Thus, when the children thought of the colour of a river, the lakeside children were more likely to say that it was white.

The children from both sites considered that *a river flows, is white, has fish in it, is muddy* and *has stones in it.* These results are in contrast with the results of the investigation uncovered by Lunnon (1969). In response to the question *What is a river?*, children aged seven to eleven, revealed that a river is *water, blue, a sort of stream* and *looks like a lake.* The difference may be explained by reference to the type of questions used to elicit responses. In Lunnon's study, the children were asked a certain definition of a river. An assessment of our pilot study affirmed that children have difficulty in giving a response to questions which require the definition of a concept. Therefore, it could be suggested that Lunnon underestimated the children's true understanding of the concept of a river.

To conclude this section, questions related to the children's first thoughts of the concepts revealed some differences and similarities in coastal and lakeside children's ideas.

With regard to the children's perceptions of the sea, the colour of the sea water (*blue* and *white*), existence of fish and waves, human activities (*swimming*) and the nature of sea water (*salty*) were regarded as the most important features of the sea by the coastal children. On the other hand, the lakeside children considered it *too big*,

blue, wide and a body of water in which fish live. Concerning the children's first thoughts of a lake, the coastal children considered that *it is deep, big, blue, marshy, there is a monster in it* and *frogs live there*. However, the lakeside children thought that a lake *is deep, big, blue, marshy, muddy* and *ducks live in it.* About the children's first thoughts of a river, the data revealed that both groups of children shared similar ideas with different frequency. The most common ideas were that *it flows, it is white, it is muddy, there are fish in it, there are stones in it* and *there is a bridge on it.* These results might suggest that children's geographical environment and the media have an influence on their understanding of the concepts.

4.5 The Children's Ideas about the Defining and Distinctive Features of the Concepts

This section focuses on the children's ideas about the defining and distinguishing features of the sea, a lake and a river. The children's ideas about these features were examined by analysing the results obtained from the picture recognition task, the labelling method, the interview technique, the group working method and the picture drawing method.

The picture recognition task comprised two parts. The first part was based on the ability of the children to identify examples of the concepts. In this part, the children were asked questions on their identification of the example, such as *Could you tell me what it is?, What do you see in this picture*? and *Could you recognise this*

picture?. The results were categorised as 'correct', 'wrong' and 'no idea' and presented via bar charts. The second part of the task aimed at revealing the reasons for their identification of the examples. In order to explore this area, they were asked such questions as *How do you know that it is the sea?, What tells you it is the sea?* and *Why haven't you said it was a lake?*. At all points, the children's understanding was probed with further subquestions where appropriate. The results were scrutinised and grouped according to the responses given.

Concerning the labelling method, the purpose of this method was to assess the children's ability to recognise the physical features of the concepts, such as *waves, a cliff* and *a beach.* The children's ability to recognise the features on a picture was classified according to one of three categories: 'correct', 'wrong' and 'no idea'. If the child identified the feature accurately on the photograph, he was put into the 'correct' category. However, if the child failed recognise the feature, he was placed into the 'wrong' category. This child here was considered as confusing the feature he was asked about with something else. If the child showed no evidence of an ability to recognise the feature, he was located in the 'no idea' category. As in the case of the presentation of the results of the picture recognition test, the results are shown as bar charts for ease of comparison.

The results of the interview technique were used to investigate the children's ideas about the colour of *sea water, lake water* and *river water*. The children were asked *What is the colour of it* [the name of the feature]? Following this question, they

were asked *Is it the same all the time*? to obtain more insight into their ideas. The responses were grouped and presented in frequency tables.

The analysis and presentations of the results of the picture drawing method and the group working method will be explained in the appropriate sections.

4.5.1 The Children's Ideas about Defining and Distinctive Features of the Sea

The children were presented with two different photographs depicting the sea. Each picture was taken from a different environment and had its own distinctive feature (Appendix A).

The absence of waves was the main characteristic of Picture 1a. The reason why this photograph was chosen was to test if the children could recognise and distinguish the concept using the criterion that it is not bounded. Since the picture did not contain any other distinguishing feature, the children had to know this feature to be able to identify it.

Figure 4.1 compares the coastal and the lakeside children's performance in their identification of the sea with respect to Picture 1a.

According to the figure, most of the coastal children (92.5%) managed to correctly identify the picture. Table 4.4 is a summary of these children's ideas about the defining features of the sea. It shows that the children considered its colour (*blue*), size (*big*), nature (*water*) and the existence of the stones on the beach as distinguishing features. Although some of them correctly identified the picture, they were not able to provide its distinguishing features. They said only *because it is the*

sea and *because I have seen it*. The children who were not able to recognise the picture correctly (5.0%) confused it with a lake.

Figure 4.1 The Children's Performance in their Identification of the Sea (Picture 1a)

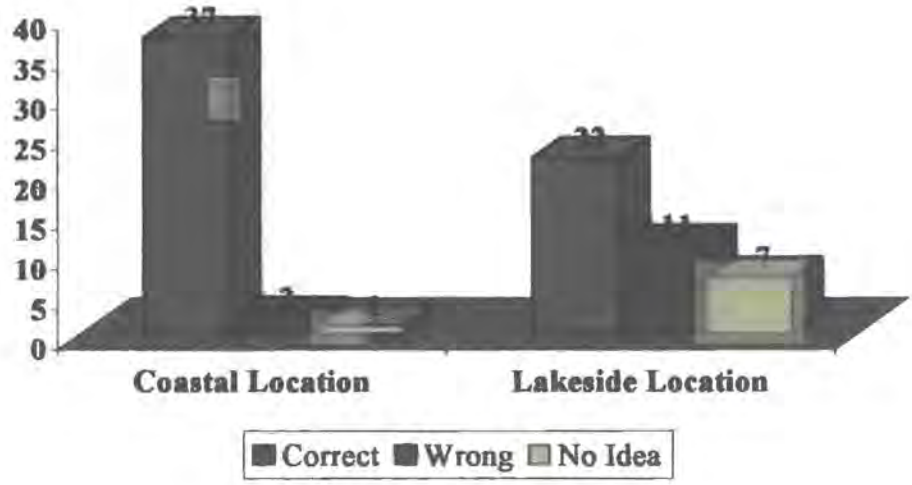


Table 4.4 The Coastal Children's Ideas about the Defining Features of the Sea in Connection with Picture 1a

	Frequency	%
Because it is blue	11	29.7%
Because it is big	8	21.6%
Because it is the sea	5	13.5%
Because there are stones around it	4	10.8%
Because it is water	4	10.8%
Because I have seen it	3	8.1%
No response	2	5.4%
Total	37	100.0%

With regard to the lakeside children's performance in their identification of the same picture, the data suggest that over half of them (55.0%) were able to identify it correctly. These children provided various responses concerning the distinguishing features of the sea. Table 4.5 summarises the responses. It indicates that ten children used its size as a distinguishing feature, stating that *it is big* and six children regarded its colour as criterial attribute, saying that *it is blue*. The rest of them could not provide a distinguishing feature, although they managed to give a correct response in identifying the example. They said simply *because it is the sea.*

Table 4.5 The Lakeside Children's Ideas about the Defining Features of the Sea in Connection with Picture 1a

	Frequency	%
Because it is big	10	41.7%
Because it is blue	6	25.0%
Because it is the sea	2	8.3%
No response	6	25.0%
Total	24	100.0%

On the other hand, the results showed that eleven children (27.5%) failed to recognise the example correctly and seven (17.5%) had no idea. Of the children who provided a wrong answer, nine (81.8%) confused it with a lake and two (18.2%) misidentified it as river.

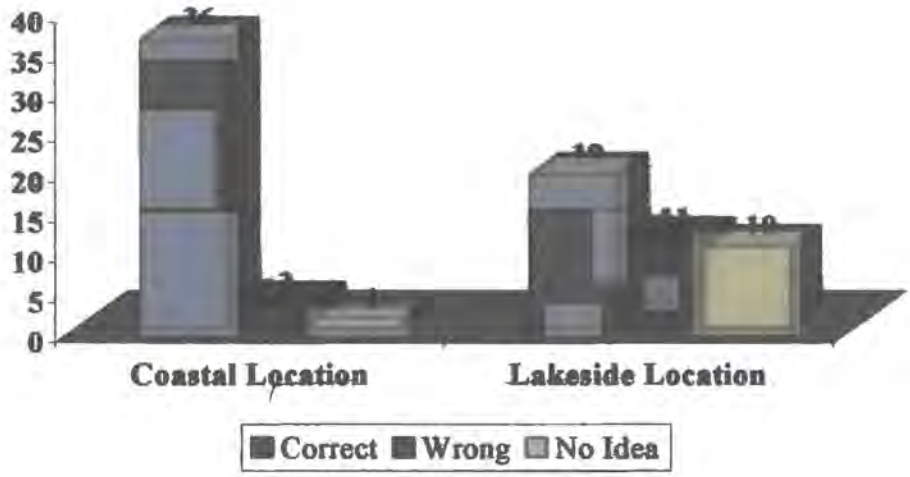
A chi-square test suggested that there is a significant difference between these two groups in their identification of the picture of the sea (P value = 14.544 > 0.05).

Analysing the results indicates that most of the coastal children had no difficulty in identifying the picture, although it did not include waves which are considered a distinguishing feature of the sea. Therefore, this outcome might suggest that the coastal children were aware that the sea is not bounded, since there was no other distinguishing feature of the sea in the picture. However, there is a possibility that the children might have used their familiarity with the shoreline as a distinctive feature to identify the picture. In contrast, the lakeside children's lower success rate on the same task might be an indication of their inability to appreciate that the sea is not encircled. Nonetheless, no certain conclusion can be drawn at this stage, since the data cannot provide sufficient evidence. Therefore, the children's drawing were used to determine whether the children were aware that the sea is surrounded by land. The results of this test will be presented in the subsequent sections.

Picture 1b showed a high cliff, a stony shoreline and easily perceptible waves (Appendix A). This picture was chosen to explore whether these features had an influence on the children's performance in the identification and differentiation of the sea.

Figure 4.2 summarises the children's performance in their recognition of this picture.

Figure 4.2 The Children's Performance in their Identification of the Sea (Picture 1b)



The figure indicates that thirty-six children (90%) from the coastal site were successful in their identification of the picture. However, three of them (7.5%) failed to give correct responses to the same questions. The remaining child could not give a response. The children who accurately identified the example provided various explanations about the distinguishing features of the sea. A summary of these explanations is given in Table 4.6.

As can be seen from the table, some pupils defined the sea in relation to the presence of a particular attribute. About 30% of the children articulated that the most important distinguishing feature of the sea was the existence of waves. The fact that there were stones around the sea in the picture was considered as a distinguishing feature of the sea by six children, which accounted for about 16% percent. A smaller proportion of the children (about 13%) considered its colour as a defining feature,

stating that *it is blue*. Four children (about 11%) thought that the picture depicted the sea *since it is big*. The children who provided wrong answers had confused it with a river.

Table 4.6 The Coastal Children's Ideas about the Defining Features of the Sea in Connection with Picture 1b

	Frequency	%
Because it has waves	11	30.6%
Because there are stones around it	6	16.7%
Because it is the sea	6	16.7%
Because it is blue	5	13.9%
Because it is big	4	11.1%
Because I have seen it	2	5.6%
No response	2	5.6%
Total	36	100.0%

With respect to the lakeside children's success in their identification of the example, nineteen children (47.5%) correctly identified the example. However, eleven children (27.5%) failed to recognise it correctly. The remaining ten children (25%) were not able to provide a response. The children who managed to identify the picture accurately gave various answers about the defining features of the sea. Their responses are summarised in Table 4.7.

Table 4.7 The Lakeside Children's Ideas about the Defining Features of the Sea in Connection with Picture 1b

	Frequency	%
Because it is big	9	47.4%
Because it is blue	6	31.6%
Because it has waves	2	10.5%
No response	2	10.5%
Total	19	100.0%

The table shows that nine children considered its size as a distinguishing feature. They said that *it is the sea, because it is big.* Six children regarded its colour as a criterial attribute, stating that *its is the sea because it is blue.* Two children perceived the existence of the waves as a criterial feature of the sea. Of the children who were unable to recognise the picture accurately, seven confused it with a lake, and four confused it with a river.

Analysing these results, it appeared that there were some similarities and differences between the coastal and lakeside children's conceptions of the sea.

Firstly, these results clearly indicate that there was an apparent difference between the coastal and lakeside children's performance in their identification of the sea. The coastal children had a more accurate perception of the picture than the lakeside children had. The reason why the lakeside children were not as successful as their coastal peers in identifying the example might be explained by the fact that they may not have had enough knowledge about the defining and distinguishing features of the sea.

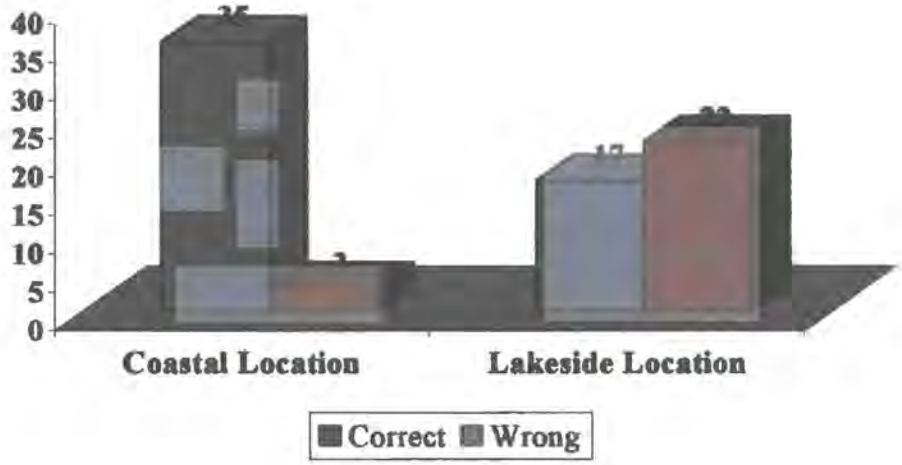
A second result was that most of the lakeside children who gave the wrong answer confused it with a lake. Since the sea was a distant environment, the boundary between the sea and a lake might have been vague or unclear for them. The vagueness might have been a consequence of the children having had insufficient information about the concept, because their understanding of the concept was largely dependent upon information obtained from indirect experience rather than direct experience. These results support the work of Bale (1987), who argues that young children's understanding of a distant environment might be incomplete, blurred or even inaccurate.

A third result, as was mentioned, is that none of the children from either group used the criterion that the sea is not completely bounded, although they identified the examples correctly. The reason why the children did not mention this criterion might be explained by considering the results of an investigation conducted by Bayliss and Renwick (1966). In the investigation, children, aged seven to eleven years, were asked to write down what they saw in a photograph of an industrial landscape. The results showed that the children's attention was focused on details such as factories, chimneys and lamp-posts. However, they were not able to make a statement about the picture as a whole or the broad features of the area. In a similar vein, the children in our study might have focused on the details such as waves and stones and ignore the fact that the sea is not encircled by land. In order to test this assertion, the data obtained from the picture drawing task were analysed and used.

The results obtained from the picture drawing task were analysed and classified according to one of two categories: 'correct' and 'wrong'. If the child drew the sea as unbounded, he was put into the 'correct' category. This child was considered to understand one of the distinctive features of the sea which is that it is not surrounded completely by land over the short distance. On the other hand, if the child drew the sea as bounded or in a line, he was placed into the 'wrong' category. This child was regarded as confusing the sea with a lake or a river. Examples of each type of picture are shown in Appendix D.

The results of the children's drawings of the sea are summarised in Figure 4.3

Figure 4.3 The Children's Performance in their Drawings of the Sea



With regard to the coastal children's performance in drawing a picture of the sea, the figure clearly indicates that most of them (about 92%) were able to draw it

accurately. However, a small proportion of them (about 8%) failed to make a correct drawing. They drew a picture of a bounded sea which may suggest that they confused it with a lake or a pool.

Concerning the lakeside children's performance of the same task, unlike the coastal children, only seventeen (about 44%) were able to draw the sea correctly. The rest of the children (about 56%) could not draw an acceptable picture.

The results showed that most of the coastal children implied in their drawings that the sea is not bounded. This result is consistent with the results obtained by the picture recognition test. That is, the children who could correctly identify the examples were able to draw 'unbounded' pictures.

On the other hand, it was revealed that over half of the lakeside children could not draw an unbounded picture. These results are also in agreement with those obtained from the picture recognition test, where 47.5 % and 55.0% of the lakeside children made an accurate identification of Picture 1a and Picture 1b respectively. These consistent results would suggest that approximately half of the children could appreciate that the sea is not bounded by land.

In conclusion, it could be suggested that the children in our study might have known that the sea differs from a lake in that it is not encircled by land, although they could not express it

A fourth finding obtained from the picture recognition test was that the size of the sea was regarded as one of its most important distinguishing features by both groups of children. Their response was that *it is the sea because it is big.* The

children's ideas about the relative size of the sea and a lake were explored further via the group working method. The results of this method were analysed by counting the correct responses given by each child in the group. The results showed that the children who considered its size as a distinguishing feature were aware that the sea is bigger than a lake. The method revealed that thirty-five children (90%) from the coastal site and twenty-seven children (67.5%) from the lakeside area described the sea as being bigger than a lake. This result would suggest that the coastal children were more successful in differentiating between the size of the sea and the size of a lake.

A fifth finding that emerged from the picture recognition test was that a considerable number of children from both sites considered the colour of the sea as a distinguishing feature. They had the idea that *it is the sea because it is blue.* This response category was combined with the results of the interview and the group working methods. The results of the interview technique are presented in Table 4.8

Table 4.8 The Children's Ideas about the Colour of the Sea

	Coastal Location		Lakeside Location	
	Frequency	%	Frequency	%
No Idea	5	12.5%	19	47.5%
Blue	25	62.5%	15	37.5%
Blue-Brown	6	15.0%	3	7.5%
Blue-White	4	10.0%	3	7.5%
Total	40	100.0%	40	100.0%

As the table indicates, the children's ideas fell into one of four categories: (a) the colour of the sea is blue all the time, (b) it is blue, but when it rains it becomes muddy, (c) it is blue, but sometimes it turns to white and (d) no response. The following two discussions are good examples of the categories (b) and (c) respectively:

E. *What is the colour of the sea?*

C. *It is blue.*

E. *Is it blue all the time?*

C. *Well, when it rains, it becomes brown.*

E. *Why do you think the rain makes it brown*?

C. *Because it makes it dirty.*

(Pupil 14, Lakeside Location)

E. *What is the colour of the sea?*

C. *It is blue.*

E. *Is it the blue all the time?*

C. *No.*

E. *What colour is it, when it is not blue?*

C. *It is white.*

E. *What makes it white?*

C. *When it rains and it is windy, it becomes white.*

E. *Why is that so?*

C. *Because the wind makes it wavy*

(Pupil 1, Coastal Location).

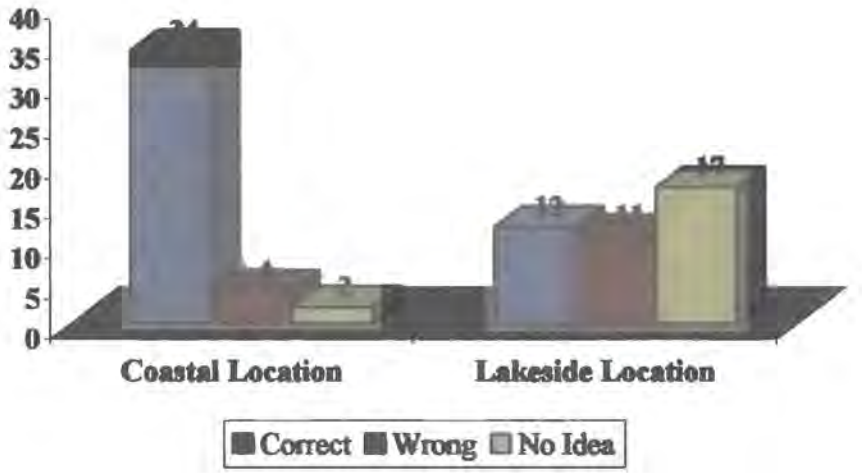
Analysing the response groups revealed some differences between the coastal and lakeside children's ideas about the colour of the sea.

The first difference was that more lakeside children had no idea about the colour of the sea than the coastal children had. The second difference was that far more coastal children regarded the sea as blue than the lakeside children did. These two differences might be attributed to the fact that the coastal children had a more comprehensive understanding of the colour of the sea.

A sixth finding of the picture recognition test was that although a considerable number of the coastal children regarded waves as distinguishing features of the sea, only a few lakeside children talked about this feature. In order to confirm and extend this finding the results of the labelling methods and group working method were analysed and considered.

The labelling method revealed that most of the coastal children were able to identify the waves in the picture (Figure 4.4). According to the figure, while thirty-four children (85.0 %) successfully identified the waves, four (10.0%) were confused it with rapids. The remaining two children (5.0%) appeared not to have an idea about it.

Figure 4.4 The Children's Performance in their Identification of the Waves



Their verbal responses showed that sixty percent of these children attributed the reason why waves occur to the rain and the wind. A small number of them thought that cold weather and snow caused waves to occur. Their explanations were mostly pragmatic. The following responses were representative:

When it is windy and rainy, it pushes the sea.

(Pupil 19, Coastal Location)

It rains too much on the sea and it overflows its shores.

(Pupil 15, Coastal Location)

It happens when it is cold and you cannot go into the sea.

(Pupil 13, Coastal Location)

Some children preferred to talk about their personal experiences when they were asked the questions about formation of waves, as in the following response:

When I was in the sea, it almost carried me away

(Pupil 17, Coastal Location).

Analysing the results of the group working method also showed that nearly all the children (92.5%) could associate waves with the sea, although a few children appeared not have an idea about waves.

The results which related to coastal children's understanding of the waves are substantiated by Eynes and Garner (1998) who carried out an investigation concerning children's ideas about landscapes. The investigation involved twenty-nine children aged five to eleven years old. The results showed that most of the children (75% to 100%) could successfully recognise the waves in the pictures. However, the lakeside children in our study recorded poor apprehension of waves. Only twelve of them (30.0%) were able to recognise the waves in the picture. Therefore, it might be speculated that the children in Eynes and Garner's investigation had either direct experience of waves or had been taught about waves.

The results of the labelling method showed that eleven lakeside children (27.5%) confused the waves with a river (Figure 4.4). However, analysing the results obtained from the labelling test in relation to a river showed that the lakeside children's confusion regarding the waves was actually related to the rapids in a river rather that a river itself. When the children were asked to identify the features on the picture of a river (Picture 3a) many of them (77.5%) perceived rapids as waves. The results of the group working method appeared to confirm these findings, suggesting that many children from the lakeside location associated rapids with waves. The following examples were extracted from the children's responses obtained via the group working method:

When the water in the river increases, it hits the rocks and becomes white.

(Pupil 27, Lakeside Location).

When it flows fast, it becomes wavy.

(Pupil 11, Lakeside Location).

Waves happen when the water flows very fast over the rocks.

(Pupil 20, Lakeside Location).

The children's confusion of waves with rapids might suggest that their ideas about waves are restricted by the local environment. This restriction may cause a misunderstanding of the term *waves* in everyday language.

Overall, the coastal children were more successful than their lakeside counterparts in their identification of waves and their causes. The difference between the two groups was significant with the p value of 25.631. Therefore, this result seemed to suggest that children are more likely to acquire the accepted scientific explanation of a phenomenon if they have constant direct experience of it.

4.5.1.1 The Children's Ideas about Coastal Features

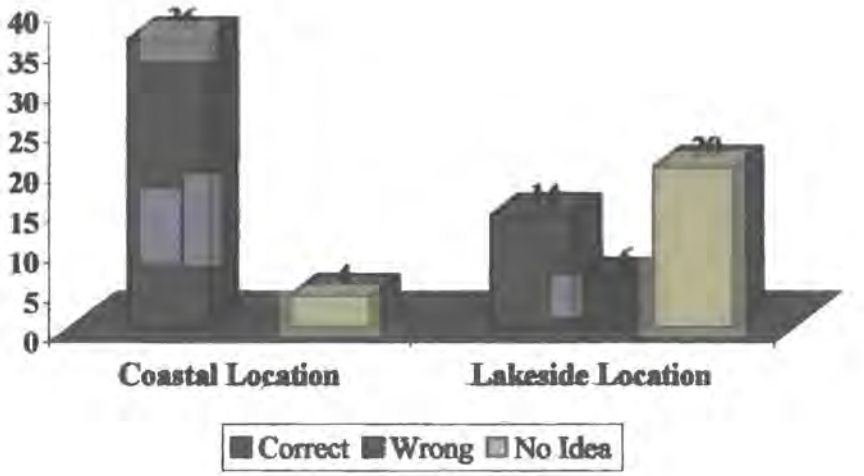
The children's ideas about *a beach* and *a cliff* were explored in this investigation. On the other hand, the other coastal features, such as *an estuary, a bay, a gulf* and *headlands* were excluded, because the pilot study revealed that these concepts are not vernacular in the spoken language in the region.

The labelling method, the group working method and verbal responses obtained from these techniques were used to examine the children's ideas about a beach and a cliff.

4.5.1.1.1 The children's Ideas about a Beach

Figure 4.5 shows the results of the labelling method in relation to the children's performance in their identification of a beach.

Figure 4.5 The Children's Performance in their Identification of a Beach



According to the figure, thirty-six coastal children (90%) managed to identify the beach. The results of the group working method also showed that most of the coastal children (97%) had a good knowledge of a beach. These children associated a beach with the sea, sand, stones, seashore creatures and swimming activities. For example, one child said *I have been there. It was sandy. There were seashells in the sand* (Pupil 3, Coastal Location). Another child stated that *we go there for a swim when the weather is good* (Pupil 12, Coastal Location).

With regard to the lakeside children's performance, fourteen children (35%) were able to recognise the beach. Six children (15%) confused it with a cliff. The remaining twenty children (50%) appeared to have no idea about it. The results of the group working method revealed that over half the children (52.5%) associated it with

the sea, sand and swimming activities. For instance, one child stated that *it is on the edge of the sea* (Pupil 21, Lakeside Location). The other child said that *people swim there* (pupil 25, Lakeside Location).

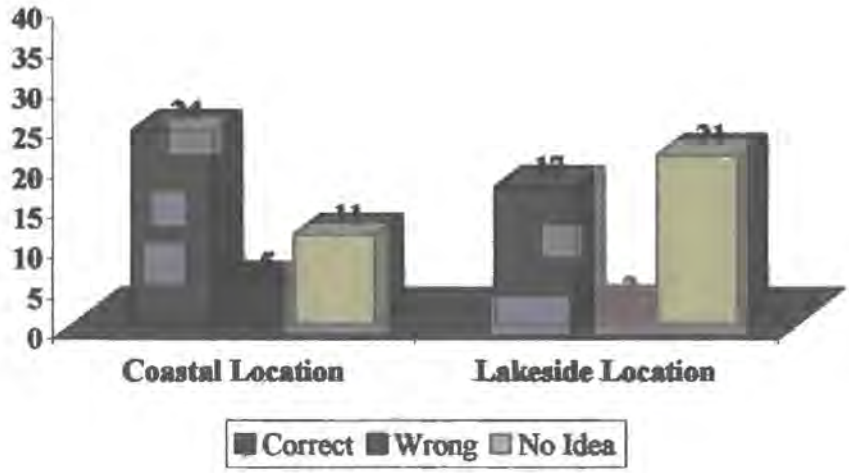
Analysing the children's responses indicated that the coastal children performed better than their lakeside counterparts in their identification of a beach. The difference between the groups was statistically significant with the p value of 26.347. However, the pattern of their responses showed similarity, as both groups of children associated a beach with the sea, sand and a holiday resort place. Although none of the children could give a strict definition, their responses included a number of close associations.

The perceptions the children have of a beach show a similarity with the results of Lunnon (1969). He investigated children's understanding of certain geographical concepts through interview and picture recognition tests and found that children aged five to twelve years associated a beach with water, the sea, sand, a holiday resort and a non-solid rock. The similarity between the results of these two studies was that the children associated a beach with the sea, sand and a holiday resort.

4.5.1.1.2 The children's Ideas about a Cliff

The children's performance in their identification of a cliff revealed by the labelling method is summarised in Figure 4.6

Figure 4.6 The Children's Performance in their Identification of a Cliff



The figure shows that twenty-four coastal children (60.0%) correctly identified the cliff in the picture. Five children (12.5%) confused it with a rock. The remaining eleven children (27.5%) had no idea about it.

Concerning the results of the group working method, a large proportion of the children (82.5%) could associate it with the coastal environment. Many of the children used their first-hand experience to describe it. For example, one child said *I climbed up to a cliff. It was rocky and high* (Pupil 8, Coastal Location). Some of them used the information obtained from television to explain it, as in the following example:

There was a man in the film. He went there and jumped down to commit suicide (Pupil 30, Coastal Location).

With regard to the lakeside children's ideas about a cliff, the figure indicates that seventeen children (42.5%) correctly recognised it. Two children (5.0%) confused it with rocks and the remaining twenty-one children (52.5%) appeared not to have an idea about it.

The group working method revealed that a larger proportion (62.5%) had an idea about a cliff. However, many of these children did not associate it with the coastal environment. They regarded it as a steep side of a mountain. The following responses contain evidence for this:

There is one up there. It is very steep (Pupil 6, Lakeside Location).

There is one just next to the river. If you go there, you fall off (Pupil 25, Lakeside Location).

Supporting this outcome, the labelling test in connection with the river revealed that nearly half of the children (47.5%) placed the 'cliff' labelled card on the steep sides of the mountain.

In short, analysing the children's responses showed that there was not a significant difference in their identification of a cliff. A chi-squire of the results has a

p value of 5.606, which suggest that the difference was not significant at the level of 0.05. However, the patterns of the responses were different: while the coastal children regarded it as a coastal feature, the lakeside children considered it as an inland feature. However, children from both sites defined it as a land which is high and steep.

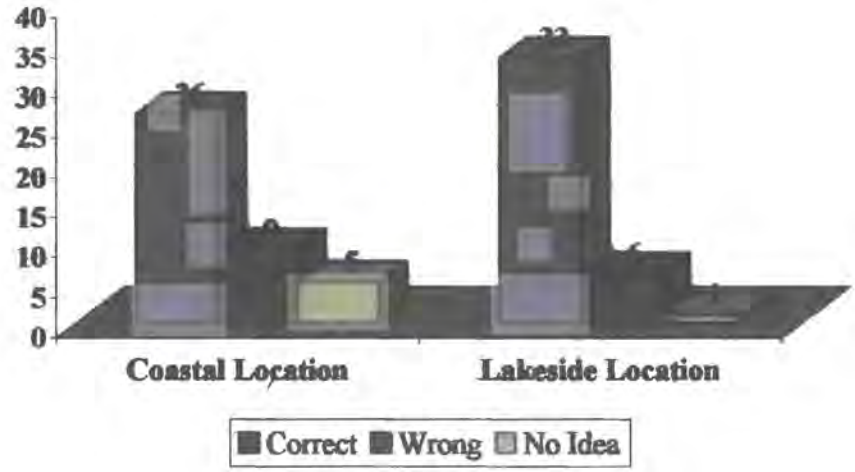
To summarise this sub-section, the coastal children performed better than their lakeside counterparts in their identification of the examples of the sea. They also appeared to be more confident in providing defining and distinguishing features of the concept, that is, they were more successful in sorting out the relative size of the concepts, determining whether it is surrounded and recognition of waves, a beach and a cliff. These results might suggest that children are likely to show a more detailed and more comprehensive understanding if their sources of knowledge are largely dependent upon direct experience rather than vicarious experience.

4.5.2 The children's Ideas about the Defining and Distinctive Features of a Lake

The children were shown two different pictures depicting a lake. The first photograph shown to the children was of the lake where the lakeside children lived. This lake has an oval shape and is surrounded by mountains (Picture 2a).

Figure 4.7 provides a summary of the children's performance in their recognition of this picture.

Figure 4.7 The Children's Performance in their Identification of a Lake (Picture 2a)



With regard to the coastal children's performance in their identification of the picture, twenty-six children (65.0%) managed to correctly recognise it. However, nine children (22.5%) failed to give a correct answer. The remaining five children (12.5%) appeared to have no idea about the picture. The children who gave a correct response provided various explanations about the defining features of a lake. Their responses are given in Table 4.9. The table shows that nine children out of twenty-six (34.6%) considered its size as a defining feature. They said that *it is a lake because it is small*. Five of them (19.2 %) attributed its defining feature to its colour, stating that *it is a lake because it is blue*. Four of them (15.4%) said that *it is a lake because there is water in it*. The rest of the eight children were not able to provide an explanation related to its defining features. The children who could not provide a correct answer

confused it with the sea or a river. While seven of them said that it was the sea, two of them thought that it was a river.

Table 4.9 The Coastal Children's Ideas about the Defining Features of a Lake in Connection with Picture 2a

	Frequency	%
Because it is small	9	34.6%
Because it is blue	5	19.2%
Because it is a lake	4	15.4%
Because it is water	4	15.4%
No response	4	15.4%
Total	26	100.0%

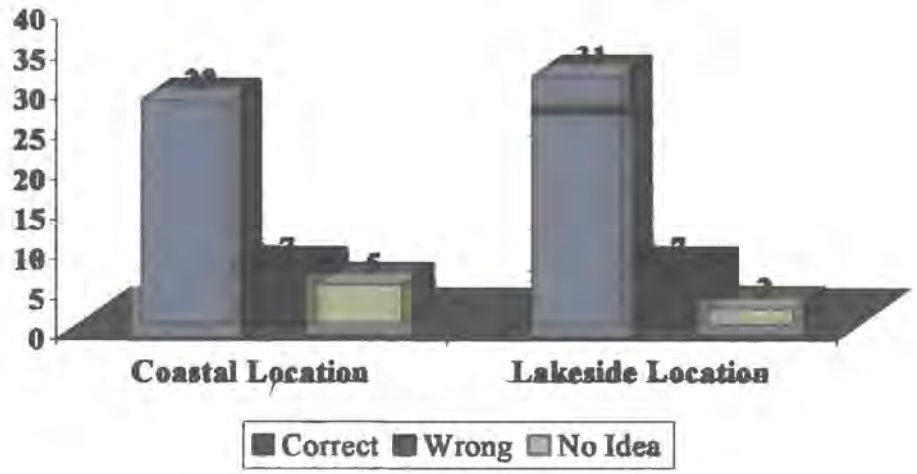
Concerning the lakeside children's performance in their identification of the same picture, thirty-three of them (82.5%) were successful in identifying the example. However, six of them gave the wrong answer. The remaining child (2.5%) could not provide a response. On the other hand, the pupils who were able to correctly recognise the example had different ideas about its defining features. Their responses are presented in Table 4.10. According to the table, ten children (30.3%) considered its colour as a defining feature, saying that *it is a lake because it is blue.* Seven of them (21.2 %) explained that *it is a lake because it does not flow.* Six of them (18.2%) claimed that they had *seen it.* Three of them (9.1%) said that *it is a lake because there is water in it.*

Table 4.10 The Lakeside Children's Ideas about the Defining Features of a Lake in Connection with Picture 2a

	Frequency	%
Because it is blue	10	30.3%
Because it does not flow	7	21.2%
Because I have seen it	6	18.2%
Because it is a lake	5	15.2%
Because it is water	3	9.1%
No response	2	6.1%
Total	33	100.0%

The second photograph shown to the children differed from the first one in terms of its surroundings. This picture was encircled by small hills rather than mountains (Picture 2b). Figure 4.8 summarises the children's performance in their identification of the picture.

Figure 4.8 The Children's Performance in their Identification of a Lake (Picture 2b)



According to the figure, twenty-eight coastal children (70.0%) identified the picture successfully, whilst seven pupils (17.5%) failed to recognise it accurately. The rest of them (12.5%) were unable to give a response to the question.

As Table 4.11 indicates, of the children who provided a correct response, seven (25.0%) considered its size as a defining feature, saying that *it is small.* A smaller proportion (21.4%) regarded its colour as a defining feature, stating that *it is blue.* However, a large number of them could not provide a defining feature, although they recognised it correctly. Their responses were *because it is a lake* and *because I have seen it.*

Table 4.11 The Coastal Children's Ideas about the Defining Features of a Lake in Connection with Picture 2b

	Frequency	%
Because it is small	7	25.0%
Because it is blue	6	21.4%
No response	6	21.4%
Because it is a lake	4	14.3%
Because I have seen it	3	10.7%
Because it is water	2	7.1%
Total	28	100.0%

Regarding the lakeside children's performance in their identification of the same picture, thirty-one children (77.5%) managed to identify it accurately. However, seven pupils (17.5%) failed to recognise it correctly. The remaining two children

could not provide a response to the questions. The children who identified it correctly gave various answers concerning why they stated that it was a lake. Table 4.12 is a summary of these answers.

Table 4.12 The Lakeside Children's Ideas about the Defining Features of a Lake in Connection with Picture 2b

	Frequency	%
Because it is blue	9	29.0%
No response	7	22.6%
Because it does not flow	5	16.1%
Because I have seen it	4	12.9%
Because it is small	3	9.7%
Because it is a lake	3	9.7%
Total	31	100.0%

As the table indicates, nine children out of thirty-one regarded its colour as its defining feature. They stated that *it is blue.* Five of them (16.1 %) considered its mood as a criterial attribute of a lake, saying that *it does not flow.* Four of them (12.9 %) said that *it is a lake because I have seen it.* Three of them (9.7 %) regarded its size as its criterial attribute, stating that *it is small.*

Of the children who failed to give a correct response, while six of them misidentified it as the sea, one of them said that it was a river (Figure 4.8).

The results indicated that the lakeside children performed slightly better than the coastal children did. Since the lakeside children were familiar with a lake, it may not be surprising that they knew its defining features better than the coastal children did.

The data also revealed that the coastal children focused on different defining and distinguishing features of a lake from the lakeside children. The verbal responses obtained from Picture 2a and Picture 2b showed that while some lakeside children tended to regard a lake as a body of water which does not flow, their coastal peers did not mentioned this characteristic. The presence of a lake and a river in their home environment may have enabled the children to make a comparison of the distinctive features. As Chambers (1998) pointed out, children benefit from contrasting experiences. Thus, the lakeside children may have known that a lake is still unlike a river, since they experienced both a river and a lake constantly and simultaneously.

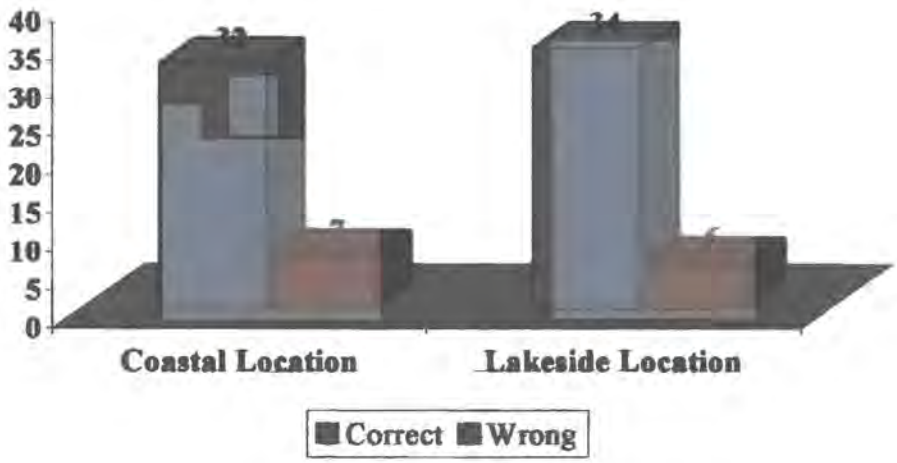
A third finding was that some coastal children seemed to confuse a lake with a pool. The data showed that eight children (20.0%) confused the lake in the Picture 2a with a pool and similarly, seven children (17.5%) confused the lake in the Picture 2b with a pool. The fact that there is a subtle difference between a pool and a lake might have led to the confusion. Investigations in this area have shown that children might have difficulty in differentiating similar geographical concepts in the early stage of understanding. For example, Eyres and Garner (1998) found that young children can confuse similar or associated terms. They explored children's ideas about landscapes

and found that children aged five to eleven years old were confused with regard to streams, rivers and valleys.

A fourth finding was that none of the children from both sites could use the criterion that a lake is surrounded by land, although many of them correctly identified it. In order to determine if the children were aware of this criterion, the results obtained from the picture drawing test were analysed. The drawings were analysed and classified in a similar way to the drawings of the sea. That is, the results were classified according to one of two categories: 'correct' and 'wrong'. If the child drew a lake as encircled, he was placed into the 'correct' category. However, if he drew a lake as unbounded or in a line, he was put into the 'wrong' category. Examples of each type of picture are presented in Appendix D.

The results of the children's drawings about a lake are shown in Figure 4.9

Figure 4.9 The Children's Performance in their Drawings of a Lake



Concerning the coastal children's performance in drawing a picture of a lake, the figure clearly shows that most of them (about 82 %) could draw it correctly. However, a small percentage of them (about 18.0%) were not able to draw a correct picture. They drew an unbounded picture which may suggest that they confused it with the sea.

Concerning the lakeside children's performance on the same task, similar to the coastal children, most of them (85.0%) made an accurate picture. The remaining 15.0% drew an unbounded picture which is considered as wrong.

It appeared that there was not a clear difference between the coastal and lakeside children's ideas of whether a lake is bounded. That is, both groups of children were successful in their drawings of a lake. The coastal children's unexpected performance in their drawings might be attributed to their confusion about the difference between a lake and a pool. Since some of them considered a pool with which they are familiar as a lake, they might have drawn an encircled picture unintentionally.

Another finding that emerged from the picture recognition test was that children regarded the colour of a lake as one of the most important distinguishing features. They considered its colour as blue. As in the analysis of the children's ideas about the colour of the sea, the interview technique was then used to reach a firm conclusion. Table 4.13 is a summary of the children's ideas about the colour of a lake.

Table 4.13 The Children's Ideas about the Colour of a Lake

	Coastal Location		Lakeside Location	
	Frequency	%	Frequency	%
No Idea	7	17.5%	5	12.5%
Blue	22	55.0%	15	37.5%
Blue-Brown	10	25.0%	8	20.0%
Blue-Brown-White	1	2.5%	12	30.0%
Total	40	100.0%	40	100.0%

The table shows that seven coastal children (17.5%) had no idea about the colour of a lake. However, over half of them (55.0%) thought that the colour of a lake was blue. Ten of them (25.0%) thought that it was blue, but bad weather turns it to brown.

Concerning the lakeside children's ideas, five children (12.5%) appeared not to have an idea about the colour of a lake. Fifteen of them stated that it was blue. Eight of them (20.0%) explained that the colour of a lake was blue or brown, depending on the weather: *When the weather is good, its colour turns blue*, however, *when the weather is rainy, it turns muddy.* The remaining twelve children (30.0%) stated that the colour of a lake *is blue in good weather, it becomes muddy when it rains* and *it turns to white when it is windy.*

Perhaps, the most interesting finding was that some of the coastal children and many of their lakeside counterparts were able to imply that there is a close link between the weather and the colour of a lake. That is, they were able to appreciate that bad weather, especially rain, turns lake water muddy.

In conclusion, it seemed that the lakeside children had less of a problem recognising the pictures of a lake than the coastal children did. In other words, the lakeside children identified more correctly the picture than their coastal counterparts did. However, a chi-square test showed that the difference was not statistically significant (the p value is 4.097 for the picture 2a and 1.438 for the picture 2b). On the other hand, there was a significant difference between the lakeside and the coastal children's performance in their identification of the pictures of the sea, the coastal children performed better than the lakeside children did (see page 99). Comparing the children's performance in their identification of the sea and a lake, it appeared that the coastal children had a more correct picture of a lake than vice versa. This result seems to suggest that the coastal children had a good understanding of a lakeside area, although it is a distant environment for them. This unexpected result might be attributed to the fact that some of the lakeside children were confused about the differences between a lake and a pool. Since they regarded a pool with which they are familiar as a lake, they might have recognised a lake unintentionally.

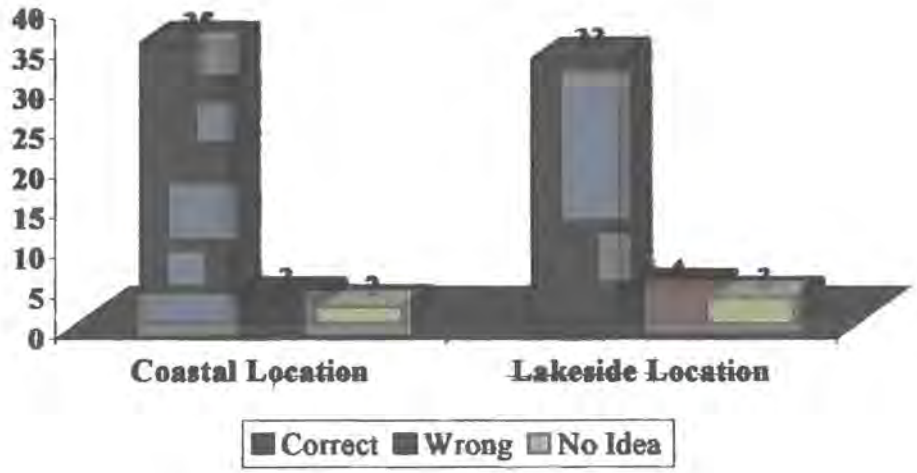
4.5.3 The Children's Ideas about the Defining and Distinctive Features of a River

As in the exploration of the children's ideas about the sea and a lake, the children were presented with two different pictures depicting a river from different places. The first one represented the river in the lakeside location. Since the

riverwater run quickly in a deep and steep valley, the colour of it was white (Picture 3a).

Figure 4.10 summarises how well both coastal and lakeside children performed in their recognition of the picture.

Figure 4.10 The Children's Performance in their Identification of a River (Picture 3a)



With respect to the coastal children's performance, thirty-five children (87.5%) managed to recognise it accurately. However, three of them (7.5%) failed to perceive it correctly. The remaining two children (5.0%) did not have any idea about it. The data revealed that the children who identified it successfully gave various responses to distinguish it from the other features. Their responses are summarised in Table 4.14.

Table 4.14 The Coastal Children's Ideas about the Defining Features of a River in Connection with Picture 3a

	Frequency	%
Because it flows	15	42.9%
Because it is white	7	20.0%
Because I have seen it	5	14.3%
Because there are stones around it	5	14.3%
No idea	3	8.6%
Total	35	100.0%

As the table shows, fifteen children stated that *it is a river, because it flows.* Seven of them regarded its colour as a distinctive feature, saying that *it is white.* Five of them said that *it is a river because there are stones in and around it.* The rest of the children could not provide any distinctive feature. However, the children who misidentified it said that it was the sea. The reason for this confusion was that they misperceived the currents on the river as waves.

Concerning the lakeside children's performance in their identification of the same picture, whilst thirty-three children were able to identify the picture successfully, four of them failed to give a correct response. The rest of them (7.5%) could not provide a response to the questions. The children who were able to identify the picture provided different kinds of responses regarding the distinguishing features of a river. Table 4.15 condenses these responses.

Table 4.15 The Lakeside Children's Ideas about the Defining Features of a River in Connection with Picture 3a

	Frequency	%
Because it flows	13	39.4%
Because it is white	8	24.2%
Because there are stones around it	6	18.2%
Because I have seen it	3	9.1%
Because it is a river	2	6.1%
No idea	1	3.0%
Total	33	100.0%

According to the table, thirteen children thought that *it is a river because it flows.* Eight of them considered its colour its distinctive feature, saying that *it is white.* Six of them regarded the stones in and around the river as its differential attributes. The rest of the children could not provide a distinctive feature of a river. Of the children who failed to provide a correct response, three confused it with a waterfall and one confused it with a lake.

The results showed that both groups of children appeared to be successful in identifying the picture. A comparison of the frequencies of the children's responses gives a p value of .402 suggesting that the difference between the two groups is not significant.

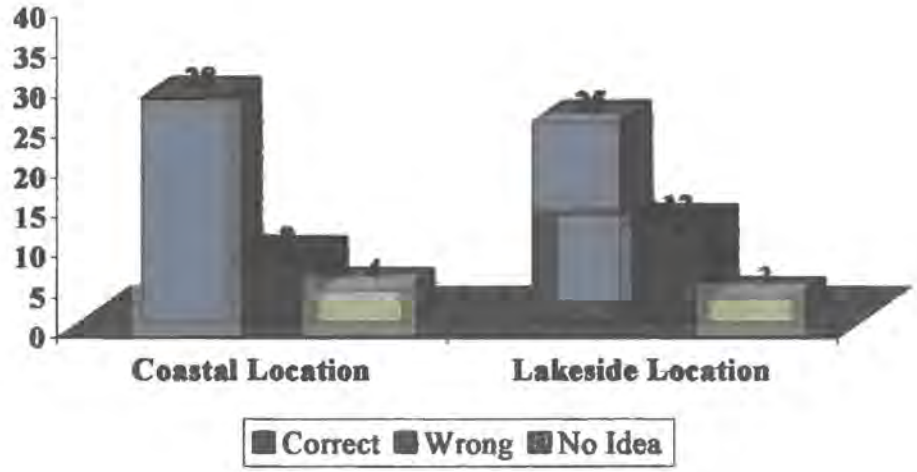
A very common response from both groups was that *it flows.* This might suggest that the children were aware of one of the most important distinctive features. A second common response was that *it is white.* This response might be attributable

to the children's familiarity with a fast flowing river. Alternatively, as suggested before, they might tend to say only what they perceive in the picture. Therefore, it is necessary to consider the children's ideas about the second picture to determine if they regarded its colour as a criterial attribute.

The second picture shown to the children had different features from the first one. Unlike the first picture, the river here was slow moving and its colour was blue (Picture 3b). Neither the coastal nor the lakeside children were familiar with this type of river.

Figure 4.11 shows the children's performance in their identification of the picture.

Figure 4.11The Children's Performance in their Identification of a River (Picture 3b)



The figure indicates that twenty-eight coastal children (70.0%) correctly identified the picture. However, eight children (20.0%) were unable to recognise it accurately. The rest of the children (10.0%) appeared not to have an idea about it. The children who provided a correct response had different ideas about its distinctive features. Their ideas are presented in Table 4.16.

Table 4.16 The Coastal Children's Ideas about the Defining Features of a River in Connection with Picture 3b

	Frequency	%
No Idea	7	25.0%
Because it is small	6	21.4%
Because it flows	4	14.3%
Because there is a forest there	4	14.3%
Because it is a river	3	10.7%
Because it is blue	2	7.1%
Because it is bended	2	7.1%
Total	28	100.0%

As the table indicated, six children considered its size as a distinctive feature, stating that *it is small.* Four of them said that *it is a river, because it flows.* Another four children thought that the forest around the river was its distinctive feature. Most of the children who failed to identify it stated that it was *a lake.*

With regard to the lakeside children's performance in identifying the same picture, twenty-five children (62.5%) were able to correctly recognise it. However, three of them (7.5%) provided wrong answers. The remaining children (30.0%) appeared not to have an idea about it. The children who were successful in identifying the picture gave different types of responses about its distinctive attributes. The responses are condensed in Table 4.17.

Table 4.17 The Lakeside Children's Ideas about the Defining Features of a River in Connection With Picture 3b

	Frequency	%
Because it flows	7	28.0%
Because there is a forest there	6	24.0%
No idea	5	20.0%
Because it is small	3	12.0%
Because it is a river	2	8.0%
Because I have seen it on TV	2	8.0%
Total	25	100.0%

According to table, seven children stated that *it is a river because it flows*. Six children said that *it is a river because there is a forest there*. Three of them considered size as a criterial attribute of a river, saying that *it is small*. The rest of them were unable to give a response about its distinguishing features. All the children who made an error in recognition of the picture stated that it was *a lake*

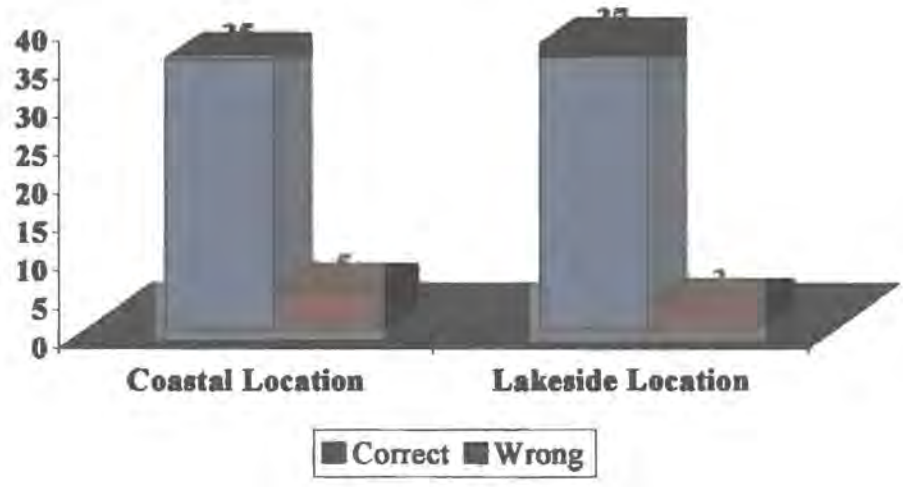
The results of the picture recognition test showed that there was a decrease in the number of children who correctly identified Picture 3b, in comparison with Picture 3a. That is, the children were more successful in identifying Picture 3a than Picture 3b. This difference has no clear explanation other than that the children's performance was dependent on the nature of a river they had experienced. As has been explained, while Picture 3a depicted the features with which the children were familiar, Picture 3b showed different features from those they had experienced. Since the children constantly observed the river in their immediate environment, most of the features of it may have become for them the distinctive attributes of the river and therefore, the children may have thought that all rivers had similar distinctive characteristics. Therefore, when they were presented with an example which showed different attributes from those they knew, they may have had difficulty in identifying it. This result might suggest that the children considered the colour of the river water with which they were familiar as a distinguishing feature of a river.

In summary, similar numbers of children in both groups had the idea that the most distinctive attributes of a river were that *it is white* and it *flows in a line*. That is, it differed from the sea and a lake in terms of its colour, mode and shape. This result might suggest that the children's ideas tended to be formed by what they perceived in their immediate environment. It is a fact that a river differs from a lake in that it flows, while the latter does not move. The difference between these concepts might have been discernible to the children since they constantly observed both of them.

To confirm the idea that *a river flows in a line*, the results of the picture drawing task were considered. The drawings were analysed and classified in a similar way to the drawings of the sea and a lake. That is, the results were classified according to one of two categories: 'correct' and 'wrong'. If the child drew a river as a line, he was placed into the 'correct' category. On the other hand, if he drew a river as circle or oval shape, he was put into the 'wrong' category. This child was considered as confusing a river with a lake or a pool. Examples of each type of picture are shown in Appendix D.

Figure 4.12 is a summary of the children's drawings. As it indicates, most of the coastal and lakeside children managed to draw a river successfully. That is, their drawings depicted a river as lines rather than circles. The results of the picture drawing test indicate that the children perceived a river as moving along in its surroundings.

Figure 4.12 The Children's Performance in their Drawings of a River



In an investigation carried out by Wilson and Goodwin (1981), the children, aged ten and twelve, were asked to write down the first eight words that came to mind when describing a river. The results showed that the responses given by ten year old children predominantly reflected the physical nature of a river: *deep, current, water, flowing, muddy, dirty* and *wide*. As has been seen, these responses implied that a river moves, in agreement with the responses given by the children in our sample. Another investigation conducted by May (1998) showed that nine-and ten-year old children held the idea that a river runs downwards. Some of the definitions given by the children are as follows:

> *Wet water running down*
>
> *Something that flows and has fish and water*
>
> *Something that runs through a hole*
>
> *Water that runs around a bank*
>
> (P. 38).

Considering these similarities, it might be concluded that children are aware that a river differs from the other bodies of water in that it flows. Since the children in our study had not been taught about a river, it seemed that they had constructed the idea that a river moves through their personal observation.

4.6 The Children's Ideas about the Source of the Water in the Sea a Lake and a River and the Final Destination of a River

This section compares the responses of the coastal children with those of their lakeside counterparts concerning the source of water in the sea, a lake and a river. It also compares their ideas about the final destination of a river. The responses which emerged from the interview were scrutinised and categorised to make a comparison.

4.6.1 The Children's Ideas about the Source of the Water in the Sea

Table 4.18 provides a comparison of the responses about the source of the water in the sea given by both the coastal and lakeside children.

Table 4.18 The Children's Ideas about the Sources of Water of the Sea

	Coastal Location		Lakeside Location	
	Frequency	%	Frequency	%
No Idea	7	17.5%	19	47.5%
River	15	37.5%	4	10.0%
Rain	5	12.5%	5	12.5%
River-Rain	5	12.5%		
River-Rain-Snow	5	12.5%		
Alternative Conception	3	7.5%		
Mountains			7	17.5%
Underground			5	12.5%
Total	40	100%	40	100.0%

Concerning the coastal children's ideas, seven of them (17.5 %) appeared not to have any idea about the source of water in the sea. However, fifteen children (37.5%) stated that a river supplied water to the sea. Five of them (12.5%) thought that the rain was the origin of the water in the sea. Another five of them (12.5%) said that a river and the rain were the main source of sea water. Again, another five of them thought that a river, the rain and the snow were the origins of sea water. The remaining three children (7.5%) had alternative conceptions about the source of the water in the sea.

With regard to the lakeside children's ideas, nineteen children (47.5 %) were unable to offer any explanation as to where sea water might have originated. Among the children who gave responses, *mountains* and *underground* were considered as the main sources of water in the sea by seven and five children respectively. In addition, five of them (12.5 %) considered *rain* as the origin of sea water and four of them (10.0 %) regarded *a river* as a main source of the water in the sea.

Analysing the data showed that there were several differences between the coastal and lakeside children's ideas about the source of the water in the sea.

The first difference was that a considerable number of the lakeside children did not have any idea about the origin of the water in sea compared with the coastal children. The results of the picture recognition and picture drawing tests showed that some of the lakeside children's ideas about differential features of the sea was limited because of lack of knowledge. It was discovered that most of the children who failed to provide an explanation about the source of sea water were the same children who

did not know the criterial attributes of the sea. This is evidence to suggest that the children could not appreciate the source of sea water because of lack of knowledge of the sea.

The second difference was that the coastal children seemed to have a more comprehensive understanding about the source of the sea than their lakeside peers did. While a number of coastal children were able to provide more than one response, none of the lakeside children offered multiple explanations. The following dialogue represents the coastal children's comprehensive understanding.

E: *Where does the sea get its water?*

C: *From a river.*

E: *Where else?*

C: *When it rains and snows.*

(Pupil 22, Coastal Location).

This result would suggest that the coastal children's comprehensive understanding of the origins of sea water was closely related to their familiarity with the sea.

The third difference was the pattern of the responses that the children gave. While several lakeside children thought that *mountains* and *underground* supplied water to the sea, none of the coastal children regarded them as the sources of sea water. Since springs are common in the place where the lakeside children lived, this

group's response was not surprising. In addition, they might have known that rivers and streams come from mountains as they had experience it. This result might indicate that the children could have used the knowledge that they obtained from their immediate environment in order to be able to explain a distant environment.

The fourth difference was that although all the lakeside children who were able to provide responses gave answers which referred to the natural origin of sea water, a few coastal children attributed the source of sea water to human activity. Pollution from domestic outflows was also considered as one of the sources of sea water, albeit very minor. For example, one child said that *dirty water goes to the sea from home* (Pupil 33, Coastal Location). However, this difference may not suggest that the lakeside children have better understanding of the sources of sea water. As was seen, almost half of them did not offer a response to the questions, which may have lowered the possibility of giving wrong answers.

4.6.2 The Children's Ideas about the Source of Water in a Lake

Table 4.19 provides a comparison of the children's ideas about the source of lakewater.

With regard to the coastal children's ideas, eleven children (27.5%) did not have any idea about the source of water in a lake. The remaining children offered a number of sources of lake water. *Rivers* and *rain* were considered as the origins of river water by six (15%) and seven children (17.5%) respectively. Eight children

(20%) were categorised as having alternative conceptions about the source of a river. Four of them (10%) thought that a lake receives its water from *mountains* and three of them (7.5%) stated that lakewater originates from *underground.* The remaining one child had the idea that both *rivers and rain* supply water to a lake.

Table 4.19 The Children's Ideas about the Sources of Water of a Lake

	Coastal Location		Lakeside Location	
	Frequency	%	Frequency	%
No Idea	11	27.5%	9	22.5%
Rivers	6	15.0%	11	27.5%
Rain	7	17.5%	3	7.5%
Alternative Conception	8	20.0%	6	15.0%
Mountains	4	10.0%	5	12.5%
Underground	3	7.5%	4	10.0%
Rivers- Rain	1	2.5%	2	5.0%
Total	40	100.0%	40	100.0%

Concerning the lakeside children's ideas, nine children (22.5%) appeared not to have an idea about the sources of lake water. The remaining children provided various responses with different frequency. *Rivers* and *rain* were regarded as the main sources of lake water by eleven (26.5%) and three children (7.5%) respectively. Six children (15%) had alternative conceptions about the source of water in a lake. Their responses were that *it gets it from sewers, it get its from drainpipes* and *God puts it there.* Five children (12.5%) thought that *mountains* supply its water and four

children (12.5%) stated that it receives water from below the surface of the ground. The remaining two children (5.0%) said that it receives its water from rivers and rain.

As has been explained, both groups of children attributed the source of lake water to *rivers, rain, mountains* and *underground.* Rivers were mentioned by the lakeside children with almost double the frequency of the coastal residents. This might be due to the fact that the lakeside children observe constantly and simultaneously that the river in the area flows to the lake.

Another finding was that some of the children from both sites appeared to hold alternative conceptions about the origin of lake water. They had the idea that a lake receives its water from *sewers*, *drainpipes* and also that *God* supplies it. This might be as a result of the children's lack of knowledge and understanding of the source of lake water.

4.6.3 The Children's Ideas about the Source of Water in a River

The children's ideas about the origins of river water are summarised in Table 4.20.

The table illustrates that eight children from the coastal site (20.0%) and seven children from the lakeside place (17.5%) were not able to explain the origins of river water.

Table 4.20 The Children's Ideas about the Sources of Water of a River

	Coastal Location		Lakeside Location	
	Frequency	%	Frequency	%
No idea	8	20.0%	7	17.5%
Mountains	9	22.5%	7	17.5%
Alternative Conceptions	7	17.5%	5	12.5%
Lakes	3	7.5%	6	15.0%
Rain	4	10.0%	3	7.5%
Rain-Underground	3	7.5%	2	5.0%
The Sea	4	10.0%		
Other Rivers	2	5.0%		
Dams			6	15.0%
Snow Melting			4	10.0%
Total	40	100.0%	40	100.0%

Regarding the coastal children's ideas, nine children (22.5%) were of the view that a river receives its water from *mountains*. Seven children (17.5%) were categorised as having alternative conceptions, since they thought that humans supplied water to a river. Four children (10.0%) thought that *the rain* was the source of river water. Another four children stated that *a river gets its water from the sea*. Three children (7.5%) regarded *a lake* as a source of the water in a river. A further three children offered multiple explanations. They indicated that a river received its water from both *the rain* and *underground*. The remaining two children (5.0%) said that a river collected its water from its tributaries.

Concerning the lakeside children's ideas, seven children (17.5%) regarded *the mountains* as the place where a river begins. Six children (15%) stated that water in a

river comes from *a lake*. Another six children said that *a dam* provided water to a river. Five children (12.5%) held the idea that a river collects its water through human activities. These children were considered as having alternative conceptions about the source of river water since they were not able to provide an acceptable natural explanation. A smaller proportion (10%) stated that a river collected its water as a result of *snow melting*. Three children (7.5%) thought that *the rain* was the source of river water. The remaining two children (5.0%) believed that a river collected its water both from *the rain* and *underground*.

As the results illustrate, the most prevalent response from both groups was that a river receives its water from the mountains. This result seems to suggest that the children developed this idea through their personal observation. Similar responses emerged from the study conducted by May (1998). In that study, the questions related to the ideas about the sources of river water revealed that one of the most common views was that a river begins in the hills.

A second finding of the current study was that some coastal children had an alternative conception about the source of river water. Four children (10%) had the idea that the water in a river originates from the sea. The fact that the children had observed that waves from the sea *make the water push into the river* may have caused this alternative conception. This finding concurs with the results of the investigations conducted by Milburn (1972), Harwood and Jackson (1993), Platten (1995b) and May (1998) who found that the direction of river flow may be misunderstood by children.

Harwood and Jackson (1993) found that two children out of nine studied considered the sea as a source of river water. One of them said that *people dig holes to the sea and the sea water goes up and fills the holes* and the other stated that *waves from the sea make the water go into the rivers and that people fill buckets from the tap and pour them into the rivers* (p. 75). The children's explanations, therefore, referred both to natural and man–made sources. That is, the children held the notion that besides having the sea as a source, a river received its water as a result of human intervention.

The third result was that while some lakeside children thought that a dam was the source of river water, none of their coastal counterparts shared the same idea. The existence of two small dams located two miles upstream from the place where the lakeside children lived might have brought about this difference. The lakeside children might have constructed the idea that a river starts from the dams as a result of their personal observation of the area.

4.6.4 The Children's Ideas about the Final Destination of a River

The children's ideas about the destination of a river were explored via the interview technique. The questions *Where does a river end up?* and *Where does it flow?* were directed to both groups of children. Although the coastal children were able to provide satisfactory answers in response to these questions, most of the lakeside children could only give simple responses, such as *over there*, *down there* and *Hocali and Inceli* (the name of the villages downstream from the lake).

Therefore, probe questions were asked, such as, *Where else does it go to?*, *Does it stop there or continue?*, *What happens to the river when it arrives there?*, *What does it do there?* These questions uncovered a number of alternative conceptions the children had.

Table 4.21 summarises the children's explanations concerning the final destination of a river.

Table 4.21 The Children's Ideas about the Final Destination of a River

	Coastal Location		Lakeside Location	
	Frequency	%	Frequency	%
No idea	2	5.0%	1	2.5%
It flows to the sea	34	85.0%	3	7.5%
It flows to a lake	4	10.0%	6	15.0%
It is endless			11	27.5%
It flows downwards			11	27.5%
There is a wall at the end of it			5	12.5%
It disappears somewhere down			3	7.5%
Total	40	100.0%	40	100.0%

The table indicates that two coastal children (5.0 %) and one lakeside child (2.5%) had no idea about the destination of a river.

A first look at the data appeared to show that the coastal children had only two responses. The first which accounted for 85% of the whole population was that the final destination of a river is *the sea.* The second, which only consisted of 10% of the total responses, was that a river ends in *a lake*.

With regard to the lakeside children's ideas, the data revealed that they provided a number of different responses. Eleven of them (27.5%) thought that *a river is endless*. Another eleven children had the idea that *a river runs downwards*. Six of them (15%) said that *it flows to a lake*. A smaller proportion (12.5%) stated that *there is a wall at the end of a river*. Three of them (7.5%) thought that it ended up at the sea. The remaining three children thought that *river water disappears somewhere down through the hills.*

From the analysis of the children's responses, it appears that there is a clear difference between the coastal and the lakeside children's ideas about the final destination of a river. While most of the coastal children knew that a river ends at the sea, only three lakeside children appeared to know this. In addition, the lakeside children held the alternative conceptions that *is endless*, *there is a wall at the end of a river* and *it disappears somewhere down through the hills.* These alternative conceptions might reflect a rudimentary understanding based on a lack of knowledge; they may not necessarily be formed from incorrect information.

May (1998) investigated children's ideas about rivers and found that the children who live in the Devon estuary area held the idea that a river ends at *the sea, land, a wall* and *sand.* The sea was mentioned most frequently, with the frequency of twenty out of twenty six. Comparing these responses with those obtained from the coastal children in our sample, it would appear that there is a consistency between the two investigations. That is, most of the children from both samples thought that a

river ends up at the sea. On the other hand, the fact that very few lakeside children held the same idea might be attributable to their lack of experience of an estuary.

4.7 The Children's Ideas about the Formation of the Sea, a Lake and a River

The children's ideas about the formation of the sea, a lake and a river were examined using the responses obtained from the interview technique.

Their responses were grouped into three distinct categories, for ease of comparison. Children who did not show any understanding of the formation of the sea were put in Category 1. Children who held the idea that the sea is made by God or humans were placed into Category 2. Children who gave a natural explanation about the formation of the sea were placed into Category 3.

Table 4.22 records the children's ideas, according to category, about the formation of the sea.

Table 4.22 The Children's Ideas about the Formation of the Sea

	Coastal Location		Lakeside Location	
	Frequency	%	Frequency	%
Category 1	14	35.0%	19	47.5%
Category 2	16	40.0%	14	35.0%
Category 3	10	25.0%	7	17.5%
Total	40	100.0%	40	100.0%

As the table shows, fourteen children (35%) from the coastal area and nineteen children (47%) from the lakeside area did not have any idea about the formation of the sea. Sixteen coastal children (40%) and fourteen lakeside children (35%) were classified as having artificial ideas. A relatively small number of children from both groups shared the idea that the sea was formed naturally.

Table 4.23 provides a summary of the children's ideas about the formation of a lake.

Table 4.23 The Children's Ideas about the Formation of a Lake

	Coastal Location		Lakeside Location	
	Frequency	%	Frequency	%
Category 1	16	40.0%	14	35.0%
Category 2	16	40.0%	20	50.0%
Category 3	8	20.0%	6	15.0%
Total	40	100.0%	40	100.0%

The table indicates that sixteen coastal children (40%) and fourteen of their lakeside counterparts (35%) were not able to give a response. Sixteen coastal children (40%) and twenty lakeside children who made up half of the whole sample appeared to hold the artificial view. These children stated that a lake was created by either humans or God. The remaining eight children (20%) from the coastal place and six children (15%) from the lakeside area) thought that a lake was formed naturally.

Table 4.24 gives the frequency and the patterns of the children's responses about the formation of a river.

Table 4.24 The Children's Ideas about the Formation of a River

	Coastal Location		Lakeside Location	
	Frequency	%	Frequency	%
Category 1	11	27.5%	13	32.5%
Category 2	17	42.5%	20	50.0%
Category 3	12	30.0%	7	17.5%
Total	40	100.0%	40	100.0%

Analysis of the data indicates that eleven coastal children (27.5%) and thirteen lakeside children (32.5%) could not offer a response to the questions. However, seventeen children from the coastal area (42.5%) and twenty lakeside children gave artificial responses. They attributed the formation of a river to humans or God. The rest of the children, that is, twelve coastal children (30%) and seven of their lakeside peers (17.5%), were able to provide a natural explanation.

As has been shown, a large proportion of the children from both groups failed to give a response when they were asked questions about the formation of the sea. Failure to understand about the formation of the sea might have resulted from the children's lack of information, because they had not been taught about it.

The fact that the children from both sites gave more artificial explanations than natural explanations might be explained by the fact that the children may have come across the belief that everything is created by God, because of the religious environment in which they lived. The following discussion was typical:

E. How did the sea begin?

C. *God created it.*

E. *How did he create it?*

C. *First of all he created the stones then he arranged them in a circle then put water in it.*

(Pupil 18, Lakeside Location)

Notwithstanding, Eyres and Garner (1998) have argued different reasons why children have artificial ideas about the formation of the natural phenomena. They stated that when children cannot provide a reasoned explanation of a physical process, they tend to give responses involving a religious explanation.

A second reason why the children gave artificial responses might be that young children construct their own ideas by observing the interaction between the environment and human beings. Most of the coastal children placed in Category 2 explained that the sea was made through human activities, because they had seen vehicles and machines working on the coast. For example, a discussion about the formation of the sea prompted the following response from one child:

The bulldozer opened a hole and put stones and rock around it, afterwards they [men] flowed water from a river (Pupil 15, Coastal Location).

Similar responses were given by some of the lakeside children to explain the formation of a lake. That is, they considered that a lake is made by humans. The children might have held this idea as a result of dam construction in the area (see table 4.20).

These results suggest that children may have alternative conceptions in their ideas arising from their direct experiences. Harlen (1993) states that children pay attention to what they see rather than to the logic which may suggest a different interpretation.

The influence of the media might be considered as a third reason. There are several instances where the children's ideas about the formation of the sea were affected by the media. One child, for example, explained the formation of the sea as, *The men in the television made it* (Pupil 20, Lakeside Location).

These results confirm the work of Piaget (1929, 1930), Stepans and Kuehn (1985) and Eyres and Garner (1998).

Piaget argued that children's explanations of the origin of natural phenomena, such as the sun and moon, sky, night, clouds, thunder, lightening, rain, rivers, lakes, seas, trees, mountains and the earth, might be artificial or natural depending on their age. Children by the age of eight or nine, explain these phenomena as artificially made. They appear to have natural explanations after nine years old. Piaget (1930) also explored children's explanations for the currents in rivers and found that they showed similar developmental stages.

Similarly, Stepans and Kuehn (1985) categorised children's explanations about the formation of natural phenomena as "religious finalism" and "true causalty". In the former, the child refers to supernatural causes, such as God or angels. In the latter, the child is able to give a correct explanation for the physical phenomenon.

To conclude, the results of the responses suggest that certain ideas predominate in the thinking of children about the formation of the sea, a lake and a river. The most common impression held by both groups of children was that the phenomena were made by humans or God. Fewer children had the idea that they were formed naturally. Since no apparent difference between the coastal and the lakeside children's ideas emerged from this study, it might be suggested that their immediate environment had no influence on their ideas about the formation of the features.

4.8 The Children's Ideas about the Living Creatures in the Sea, a Lake and a River

The children's ideas about the life in the sea, a lake and a river were investigated via the interview and group working method. Concerning the interview technique, most of the children provided more than one response because of the nature of the questions. Following the first set of questions which were *Is there a living being in it* [the name of the concept]?, *Do you think anything would live in it* [the name of the concept]?, *Could you tell me what it is?* and so forth, they were prompted by such questions as *What else?* and *Is there anything else in it?* which

were designed to obtain more insight into the children's ideas. These probe questions led the children to give multiple explanations. Their explanations were categorised and tabulated according to the names they gave to the living beings. In addition, the answers obtained via the group working method were considered to reinforce or contradict the results of the interview.

4.8.1 The Children's Ideas about Living Creatures in the Sea

Table 4.25 gives the frequency with which living creatures were mentioned by the coastal and lakeside children.

Taking into account the frequency of the each word used to describe a living being, the data shows that most of the responses given by the coastal children contained the idea that *fish live in it*. Similarly, a majority of the lakeside children (80.0%) expressed the idea that *fish live in the sea*. In addition, the group working method produced similar results revealing that all the coastal and most of the lakeside children (92.5%) associated fish with the sea.

The fact that most of the lakeside children knew that fish live in the sea was unexpected. The picture recognition and the labelling methods revealed that no more than 65% of the lakeside children could recognise any of the examples. Similarly, in the picture drawing task, just over 40% of the children were able to draw the sea correctly. These results suggest that some children were able to assign fish to the sea, although they did not have an idea about the defining and distinguishing features of the sea. This contradiction might be attributable to the following reasons.

Table 4.25 The Children's Ideas about Living Creatures in the Sea

	Coastal Location		Lakeside Location	
	Frequency	%	Frequency	%
Fish	5	12.5%	11	27.5%
Fish-Anchovy-Whiting	11	27.5%		
Fish-Shark-Dolphin	5	12.5%		
Fish-Anchovy-Dolphin	5	12.5%		
Fish-Anchovy-Jellyfish-Bonito	4	10.0%		
Fish-Anchovy-Whale	4	10.0%		
Fish-Shark-Tortoise	3	7.5%		
Fish-Anchovy-Shark-Bonito	2	5.0%		
No Idea	1	2.5%	8	20.0%
Fish-Duck			5	12.5%
Fish-Dolphin			5	12.5%
Fish-Frog-Duck			4	10.0%
Fish-Shark-Crocodile			3	7.5%
Fish-Shark-Snake			2	5.0%
Fish-Anchovy-Duck			2	5.0%
Total	40	100.0%	40	100.0%

Firstly, the children might have been able to associate fish with water since they knew that fish existed in the river and the lake they were familiar with. Therefore, they could make a connection between water and fish in their minds when they were asked questions about living creatures in the sea. Secondly, the children might have obtained information about the living beings from adults and the media. Therefore, they could associate fish with the sea since the concept *sea* is commonly used in connection with the concept *fish* in the media and among adults.

A closer analysis of the data indicates that a different pattern of responses occurred between the coastal and lakeside pupils. While the coastal children mentioned *whiting, dolphin, bonito, whale, jellyfish* and *tortoise*, the lakeside children talked about *duck, frog, crocodile* and *snake*. *Anchovy, shark* and *dolphin* were mentioned by both groups of children with different frequency. As has been seen, the responses given by the coastal children referred to the specific fish name. This difference might be attributed to the coastal children's day-to-day encounters with information concerning the fish commonly found in the market. This finding supports the results obtained by McDonald and Bethel (1996), who investigated similarities and differences in the knowledge regarding marine organisms of students from coastal and inland locations in South Texas. They found that the coastal students performed better than their inland peers in identifying marine organisms.

Another finding which emerged from the data was that the children who gave more than one fish name were mostly from those families involved in fishing. This result is not surprising, because the children were exposed to names of fish, such as anchovy, whiting and bonito which are commonly found in the region.

Further analysis of the data revealed that the children's ideas about the life in the sea were influenced by the media. The evidence comes from the responses of both groups of children which stated that *a shark, a dolphin, a whale* and a *crocodile* existed in the sea. In order to obtain the source of their information, the question *How do you know that*? was asked. Analysing the responses to this showed that the children had acquired their information from the media, in particular, television.

Therefore, it appears that the information that shapes children's ideas about the living beings in the sea is derived not just from personal observation and experience but from secondary information, the media and adults.

4.8.2 Children's Ideas about the Living Creatures in a Lake

The frequency of response of both groups of children to questions related to living beings in a lake are shown in Table 4.26

Table 4.26 The Children's Ideas about Living Creatures in a Lake

	Coastal Location		Lakeside Location	
	Frequency	%	Frequency	%
No Idea	11	27.5%	4	10.0%
Fish	8	20.0%	6	15.0%
Fish-Monster	7	17.5%	2	5.0%
Fish-Crab	4	10.0%		
Fish-Frog	2	5.0%		
Fish-Whale	2	5.0%		
Frog-Snake-Shark	4	10.0%		
Fish-Frog-Crocodile	2	5.0%		
Fish-Duck			8	20.0%
Fish-Moss-Beetle			7	17.5%
Fish-Frog-Duck			4	10.0%
Fish-Snake-Beetle			4	10.0%
Fish-Snake			4	10.0%
Fish-Snake-Shark			1	2.5%
Total	40	100.0%	40	100.0%

Regarding each word which represents a living being, fish was mentioned most frequently by both groups of children. *Frog, monster, snake* and *shark* were also mentioned from both sites with children different frequency. However, there were some differences between their ideas: while the coastal children had the idea that *crab, whale* and *crocodile* live in a lake, the lakeside children held the idea that *duck, moss* and *water beetle* live in a lake.

The results, as summarised above, indicate that there are some similarities and differences between the coastal and lakeside children's ideas regarding living beings in a lake.

The data revealed that the children possessed several alternative conceptions about living beings in a lake. One of them was that *a monster lives in a lake*. This idea was held by seven coastal (17.5%) and two lakeside children (5.0%). The existence of this idea might be related to the influence of the media (see section 4.4.2). The following response given by a child indicates the influence of the media:

It was on the TV. There was a big lake there. They said that there was a big monster in it. I could only see its head (Pupil 15, Coastal Location).

A detailed analysis of the data showed that the proportion of the coastal children who associated a monster with a lake is greater than the proportion of the lakeside children. The reason why the lakeside children tended not to accept this fantasy might be attributable to the influence of their local experience. When they

were asked questions about a lake, their attention might have been called to the particular features related to the lake that they had experienced, such as the existence of ducks, the colour and the shape. This might have caused the features of a lake in a distant environment to be unimportant in their minds. Similarly, the reason why the coastal children seemed to accept the idea that a monster lived in a lake might be explained by the fact that this fantasy could have become salient in their minds since the media was the primary source of information about a lake.

A second alternative conception was that *a shark and a whale live in a lake.* This alternative conception was held by six coastal children and one lakeside child. The difference in the frequency of this response might be attributable to the reason mentioned above.

Considering these two results, it might be suggested that the influence of the media on the children's understanding of a distant place is more pronounced than on their understanding of the immediate environment. Nevertheless, further research is needed to determine the influence of the media on children's images of both their immediate and distant environment.

Taking into account this result, it might be suggested that the children who are not familiar with a lake might have alternative conceptions because of the influence of the media. In relation to this result, Palmer (1993) pointed out that young children frequently have a confused or inaccurate understanding of distance places with which they are not familiar, often brought about by images portrayed through the media.

Similarly, Platten (1995a) and Keliher (1997) asserted that children may hold alternative conceptions because of the influence of television.

4.8.3 Children's Ideas about the Living Creatures in a River

The responses of the children to the questions about living beings in a river are shown Table 4.27.

Table 4.27 The Children's Ideas about Living Creatures in a River

	Coastal Location		Lakeside Location	
	Frequency	%	Frequency	%
Fish	15	37.5%	17	42.5%
Fish-Snake	5	12.5%	4	10.0%
Fish-Frog	4	10.0%	2	5.0%
Nothing	4	10.0%	2	5.0%
Fish-Shark	2	5.0%	3	7.5%
Fish-Crab	6	15.0%		
Frog	3	7.5%		
Fish-Whale	1	2.5%		
Fish-Duck			10	25.0%
Worm			2	5.0%
Total	40	100.0%	40	100.0%

Analysing the data in the table shows that there are some similarities and differences between the children's ideas.

Their ideas showed similarity in that most of them had the idea that *fish* live in a river. In addition, some of them shared the idea that *snakes, frogs* and *sharks* live in a river. However, their ideas differed from each other in that while several coastal children held the idea that *crabs* and *whales* exist in a river, a number of lakeside children thought that *ducks* and *worms* live in a river.

It seems likely that the children's awareness of living beings was the result of direct experience, the influence of media and adults. The evidence was derived from the children's answers in response to the question *How do you know that?* For example, one coastal child said that *when it gets sunny, my elder brother takes me to the river to catch fish* (Pupil 20, Coastal Location). Similarly, his lakeside peer explained his direct observation as *there are too many small fish at the edge of the river* (Pupil 3, Lakeside Location).

A small number of children from both sites seemed to be influenced by the media. These children held the idea that *a shark* and *a whale* live in a river. Similar responses appeared in an investigation conducted by Harwood and Jackson (1993). For example, one child included a shark's fin and an octopus in her drawing of the river. These results might suggest that the media might cause alternative conceptions in children's understanding of a concept.

Analysing the results also showed that four coastal children (10.0%) and two lakeside children (5.0%) implied that there are no living beings in a river. The following responses are good examples of the reasons why the children thought that living beings do not exist in a river:

Because living beings live in salty water (Pupil 22, Coastal Location).

Because it doesn't have enough water (Pupil 14, Coastal Location).

Because its water has microbes. (Pupil 37, Lakeside Place).

Because *it runs too fast. It carries away everything* (Pupil 15, Lakeside Location).

Considering these responses, the reason why the children held these misconceptions might be attributable to the lack of knowledge they had. They might not have acquired the knowledge that living beings exist in a river because of lack of first-hand or/and vicarious experiences. However, it should be noted that the total number of these children is only six out of eighty which might be considered not to be significant. Therefore, using appropriate techniques, additional research is needed to determine whether instruction or direct observation causes alternative conceptions in relation to the living beings in a river.

4.9 Conclusion

The results which emerged from the investigation may be summarised as follows.

The coastal children showed better appreciation of the concept of *the sea* than their lakeside counterparts did. The results indicated that more coastal children appreciated the distinguishing features of the sea. That is, they were more aware that the sea is not immediately bounded by land and that it is salty. The results also showed that the coastal children had a better understanding of *waves*. While they could recognise waves and explain why they occur, their lakeside peers showed limited understanding of them. Another result was that the coastal children's appreciation of a *beach* was more comprehensive. More coastal children were able to recognise it correctly and they were more able to associate it with the sea than the lakeside children. Concerning their understanding of *a cliff*, there was not a significant difference the children's recognition of *a cliff*. However, while the coastal children associated it with a coastal environment, the lakeside children associated it with an inland environment. Another difference was that the coastal children had a more accurate understanding of the source of sea water (i.e. rivers), than the lakeside children did. With regard to their understanding of the living beings in the sea, the coastal children had more extensive knowledge; that is, they were able to give the names of more living beings' in the sea than their lakeside counterparts.

On the other hand, the lakeside children appeared to have a more comprehensive understanding of the concept of *a lake* than their coastal counterparts. The results indicated that more lakeside children recognised a lake than their coastal peers did. However, the difference was not significant. The results also showed that the coastal children had difficulty in distinguishing *a lake* from *a pool*, while the lakeside children did not. Another result was related to the colour of a lake. The lakeside children had more detailed knowledge about the colour of a lake. That is, they gave multiple responses and implied that there was a close relationship between the weather and the colour of a lake. Similarly, the lakeside children had more specific knowledge about living beings in a lake than the coastal children had.

With regard to the children's understanding of a *river*, the results indicated that there was not a big gap between the coastal and lakeside children's understanding of the criterial features of a river. Both groups of children considered that it was white and it flowed. However, their ideas about the final destination of a river differed: while most of the coastal children had the idea that a river flows into the sea, many of their lakeside counterparts did not know that a river ends up at the sea.

The differences between the children's ideas about the sea and a lake suggest that children's direct experience of the physical environment has an influence on their conceptual understanding. This result has a relevant link with Skinner and Bruner's learning theories.

Skinner's learning theory is based on stimulus-response relationship. Considering this theory in relation to the current study, when the child experiences a

geographical feature in the environment (stimulus), he/she considers and verbalises it (responses behaviour), and therefore learning occurs. The stimulation can take a variety of forms, such as visual, auditory, tactile and taste. The most common stimulation in our study was in visual form. The responses *It is blue, It is muddy, It flows, It is big* e.t.c. were the examples of this kind of stimulation. There were also responses which suggest that the children were stimulated by their sense of touch and taste (i.e. w*hen it touches your body, you get red* and *it is salty*). Considering these responses, Skinner's theory helps to explain how the children gained knowledge and understanding of the geographical environment through their direct experience.

With regard to Bruner's theory, he argues that learning occurs in three ways: through doing it (enactive), through seeing an image or picture of it (iconic) and through symbolic form of it (symbolic). It seems that the children in our study constructed most of their knowledge through the iconic mode. The responses such as, *I have seen it, There is one down three, It is blue, It is white, It is muddy, It flows, It is big and It is small* suggest that the children gained knowledge as a result of visual experiences of the physical features.

Another result was that some children were confused about geographical terms. The most common confusion the coastal children had was that they considered that the terms *a lake* and *a pool* had the same meaning. On the other hand, some of the lakeside children confused *waves* with *rapids*. These results might suggest that children tend to confuse words with similar meaning.

It seems that there is a relevant link between this finding and Vygotsky's ideas. A main theme in Vygotsky's work is the role of language in concept formation. For him, language was basic to development of thought; words are the means through which thought is formed and communicated. Children learn words via interaction with adults. Therefore, in the current study, the children's confusions of the terms might be explained by the fact that they failed to develop the meanings of the words because of the lack of interaction with adults and each other.

The study revealed that some of the children from both sites gave tautological answers in response to the questions relating to the definition and distinctive attributes of the feature. For instance, some coastal children who correctly identified the picture of *a lake* said that *because it is a lake* when they were asked *how do you know it is a lake* (see table 4.11). The existence of the tautological answers might be explained by the fact that the children had language difficulties in expressing their ideas or they completely lack understanding. When they cannot make explicit their ideas they resort to repeating the responses they had given before. However, a close look at the data indicates that the tautological responses are not predominant throughout the children's responses. Therefore, additional research is needed to determine why children of this age resort to tautological responses.

The data showed that there was not an apparent difference between the coastal and lakeside children's ideas with respect to the formation of the concepts of *the sea* and *a lake*. Both groups of children held artificial explanations rather than natural

explanations. This result suggested that direct experience of the physical environment did not influence the children's understanding of the formation of the features.

This result also suggested that both groups of children held some alternative conceptions regarding the *sea, a lake* and *a river*. That is, they had the idea that the features were formed by humans and God.

Piaget believes that there is an age-related stage in children's thinking. His investigations show that children up to seven or eight years tend to take for granted that natural phenomenon are human or God constructs. The results of the present study also showed that the children from both sites tended to give artificial responses. Therefore, it would be suggested that the results related to the children's explanations of the features are consistent with the Piagetian stage of conceptual development.

A final result was that some of the coastal children and a few of their lakeside peers thought that a monster lived in a lake. The existence of this alternative conception was attributed to the influence of the media and general cultural influences.

Chapter Five

Implications for Teaching and General Conclusions

IMPLICATIONS FOR TEACHING AND GENERAL CONCLUSIONS

5.1 Introduction

The major findings of the study will be presented in this chapter, in order to explain and support the implications suggested. The findings have implications for both teaching geography in general and the Turkish Curriculum in particular.

5.2 Implications for Teaching Geography

The results of the investigation reinforce the need for teachers to pay close attention to children's knowledge base when choosing an appropriate teaching method. In order to determine the knowledge base of their students, teachers are advised to carry out action research using multiple research techniques.

Erickson (1979) stressed that appreciating what the learner knows is important to both teachers and curriculum planners. Wilson and Goodwin (1981) recommended that classroom research would help teachers to determine students' perceptions of a particular topic or concept. Similarly, Wilson and Widt (1982), Osborne and Cosgrove (1983) and Harwood and Jackson (1993) suggested that teachers should assess children's ideas and their misconceptions using a variety of methods.

The results of the current investigation suggest that it could be useful to use multiple research methods to explore children's initial ideas, because there were many instances where one method could not reveal the children's ideas which another method could reveal. For example, while none of the children was able to say that the sea was not bounded in the picture recognition test, most of them managed to express it in the picture drawing test. In addition, it was revealed that different methods might produce different results. For instance, in most cases, the children performed better in the group working method than they did with the interview technique. Similar findings emerged from the investigation conducted by Harwood and Mcshane (1996), who found that children performed better when using jigsaw pieces method than they did in the oral tests. For this reason, as Harwood and McShane (1996) have indicated, teachers are advised to use multiple research techniques to reveal children's true understanding before teaching physical geographical concepts.

This investigation provides evidence of a relationship between direct experience and children's understanding of physical geographical concepts. The previous investigation in this area has also suggested that there is a link between children's direct experience of the physical environment and their conceptual understanding. Acknowledging and appreciating the strong relationship between conceptual understanding and direct experience suggests that fieldwork should be regarded as an effective method to teach physical geographical concepts. In agreement with this suggestion, Martin (1995) states that fieldwork enables children to learn about their world through direct experience. She maintains that fieldwork

provides children with an opportunity to explore, observe and discover things that cannot be achieved in the classroom.

One of the findings was that many of the lakeside children failed to differentiate the sea from a lake. Teaching these children in the field might enable them to differentiate a lake from the sea, because they would have an opportunity to compare and contrast their distinguishing features. For instance, they would be able to appreciate that the sea is bigger than a lake, since they would have experienced both features. They would also observe waves, cliffs, beaches and estuaries, and therefore, they would be able to compare them with the lakeside features.

Another finding implies the significance of fieldwork was related to children's alternative conceptions. For example, the lakeside children had alternative conceptions about the final destination of a river. Some of them had the idea that a river was endless and some that there was a wall at the end of a river. In order to repair these kinds of alternative conceptions resulting from their lack of knowledge, a field trip to an estuary would be useful. Through direct observation, children could develop a sound understanding of the final destination of a river and, therefore, they could give up the alternative conceptions they held. In relation to this issue, Sheridan (1968) recommended that teachers should make an effort to clear up alternative conceptions via a field trip.

A third finding which provides evidence of the necessity of fieldwork was about the confusion of some geographical terms. The most common confusion the coastal children had was that they considered that the terms *a lake* and *a pool* had the

same meaning. On the other hand, some of the lakeside children confused *waves* with *rapids*. These results might suggest that children tend to confuse words with similar meaning when they lack experience of the concepts described. Associated with this result, Milburn (1972) and Gagne (1997) proposed that first-hand experience through fieldwork results in an apparent increase both in the vocabulary that children use and the accuracy with which they apply it.

The investigation also provided evidence that fieldwork would be more useful if it took place in a contrasting environment. The picture recognition test showed that while the lakeside children tended to regard a lake as a body of water which was still, their coastal peers did not mention this characteristic. The reason for the difference was attributed to the presence of a lake and a river in the lakeside place, because the children were able to make a comparison of the distinctive features each of them. Considering this result, it could be suggested that places which have contrasting geographical features should be chosen for fieldwork, because children can be shown how the features are similar and how they differ. For example, choosing an area which has a lake, a pond, a pool and a puddle can be beneficial in teaching these features, because children can compare and contrast their relative sizes to differentiate them.

A close analysis of the results suggests that although children's direct experience has a positive influence on their conceptual understanding, it does not guarantee that it enables them to demonstrate a comprehensive understanding. There were still a large number of alternative conceptions and 'no ideas' even amongst

those with direct experience. In addition, it was revealed that some children held tautological thinking, possibly relating poor language development or a complete absence of understanding.

The teacher's role is, therefore, still very important as the mediator of key ideas. The teachers interventions during the fieldwork activities might be useful in correcting the children's alternative conceptions. Without a teacher's intervention, there is a danger that children's alternative conceptions persist even after the fieldwork. The teachers, should act as a guide and supervisor, participant in learning, evaluator and facilitator in the field. Fieldwork activities also should facilitate language acquisition and development, because Vygotsky considers the language as a tool to support and promote concept learning.

However, fieldwork may not be a feasible option in teaching every aspect of a feature. The results of the investigation suggested that there was not a significant link between direct experience and the children's conceptions about the formation of the features. That is, even the children who had directly observed the features showed lack of understanding of the formation of the features.

Taking this into account it could be suggested that teachers should consider children's alternative conception explicitly as a starting point for instruction. Since the study did not provide sufficient evidence that the physical environment influences children's understanding of the formation of the physical geographical concepts, fieldwork should not be considered as the most appropriate method to tackle children's alternative conceptions. Yet, it could be suggested that teachers should

place children in situations in which they have to appraise empirical evidence that is opposed to their beliefs. This can be done by showing children, in relevant laboratory activities, empirical observations which are not consistent with their current beliefs. Therefore, teachers should design simulation activities to help children to give up their artificial explanation and accept natural explanation.

Strictly speaking, teaching the formation of geographical features through fieldwork might not be as effective as teaching it through simulation activities in the classroom. Young children might have difficulty in conceptualising the formation of a physical feature through field teaching, because the process of geomorphological formation cannot be observed directly. Taking the formation of a river as an example, children's cognitive capability might not be adequate for them to understand how water erodes the land for thousands of years due to gravity. However, they can observe this process in the laboratory instantaneously, and therefore, they can develop sound knowledge about it and accept the natural explanation.

Thus, where teachers do not have an opportunity to provide a field trip, hardware models should be considered as an alternative way to teach physical geographical concepts. For example, using a model of a river course from mountain to coast, children can observed that the water runs downhill and finally reaches the sea. This model can help children to appreciate the sources of water of a river, final destination of a river the formation of a river. It also helps children to identify the physical features of a river basin, such as, hills, mountains and valley, since it provides a three-dimensional representation.

The results of the investigation also imply that teaching physical geographical concept through ICT could be beneficial. Since computer programs offer an opportunity to simulate the formation of the geographical concepts, it helps children to develop their conceptual understanding. For instance, a simulation program concerning the formation of a volcanic lake enables children to understand that how rain or spring water fills the craters of extinct volcanoes. As the children view its motion and hear its sound, they begin to construct images in their mind of how the lake forms.

Another advantage of ICT is that computer-based models can enhance children's understanding of the physical geographical features. Using modelling software children can recognise and differentiate geographical features, because it enables them to view the features from a three dimensional perspective. Modelling can also enables children to rotate the images and therefore they can view them from any position.

Considering the benefits of ICT in teaching geographical concepts, it can be suggested that it should be introduced as a means of enhancing and improving geographical teaching and learning.

5.3 Implications for the Turkish Curriculum

The findings of the study showed that eight-year old children can tackle physical geographical concepts of which they have direct experience. This finding may have implications for the Turkish Primary School Curriculum.

An analysis of the Turkish Primary Curriculum showed that physical geographical concepts occupy a surprisingly insignificant position in the syllabus. In the first grade (that is, at seven years old), there is no requirement to teach any concept related to geography. In the second grade, for children of eight years of age, only the concept of the *seasons* which can be considered as related to geography is included in the curriculum. For the third grade, physical landscape features are introduced to the curriculum. That is to say, children of nine years old are required to be aware of the concepts with which they are familiar, such as a mountain, a hill, a plain, a stream, a river, a lake, the sea, an island, and so on.

As has been seen, the curriculum is focused on the teaching of the physical landscape concepts at the third grade (nine years old). However, this investigation revealed that eight-year-old children could grasp concrete geographical concepts. This result corresponds to the Piagetian stage of conceptual development. Piaget argues that eight-years-old children are in the *concrete* stage and therefore they can readily understand concrete concepts. Similarly, Watts (1998) states that young children develop some basic geographical concepts at a very early age. For example, children as young as three or four can describe different landmarks. Therefore,

concrete geographical concepts with which children are familiar should be introduced into the curriculum before the age of nine.

Since the Turkish curriculum does not suggest how to teach geographical concepts, the teachers have to develop their own teaching strategies. Therefore, the suggestions made in the previous section might be valuable to the Turkish teachers.

The strong link between conceptual understanding and direct experience supports the inclusion of fieldwork in the Turkish primary syllabus. If the teacher could take advantage of the physical environment as a learning laboratory, physical geographical concepts may become better understood by children. Considering its importance in teaching geography, the teachers should be encouraged and given opportunities to have fieldwork.

Another suggestion was that simulation activities using hardware models and ICT could enhance the teaching and learning of physical geography. That is, the evidence from this investigation suggests that such activities can establish a good conceptual framework for development of conceptual understanding in physical geography. Since ICT is a relatively new development, some teachers might not be qualified enough to use it. For this reason, the teachers should be trained to use ICT in teaching geography. In other words, the teachers should have knowledge, skills and understanding regarding the use of computer technology to assist their teaching.

5.4 General Conclusion

The study examined the influence of geographical environment on concept learning via a selected range of data collection techniques. It revealed that children's perceptions of the concepts concerning physical geography relate to their familiarity with and experience of the local environment. Specifically, the data supported the assertion that the children who have direct experience of a geographical feature are likely to have more detailed and comprehensive understanding then the children who have a vicarious experience.

Using the results which emerged from the investigation, a number of implications have been suggested for both teaching geography in general and Turkish geographical education in particular.

It has been suggested that children's initial perceptions, formed through both direct and vicarious experience, should be taken into account as a starting point for instruction. It was suggested that teachers use multiple research techniques in their action research to explore children's knowledge base. It has also been suggested that teachers should employ a variety of teaching techniques, including field trips, simulation activities, hardware models and ICT graphic packages. The data emphasised the need for fieldwork to be given priority in teaching the defining and differentiating features of physical geographical concepts. Where teachers do not have an opportunity to provide a field trip, hardware models should be used to bring the reality of the physical environment into the classroom. ICT was also considered

as a powerful and effective tool to teach physical geographical concepts. However, teaching about the formation of physical features should be carried out via simulation activities in the schools.

With regard to the Turkish Curriculum, it has been suggested that basic concrete geographical concepts should be introduced into the curriculum in the second grade at the latest. It was also suggested that the teachers should use a variety of teaching techniques including fieldwork, hardware models and ICT.

5.4.1 Problems Encountered in the Data Collection

Despite the successful completions of the data, the process was not without major problems, implications and reflections. This section focuses on the problems I encountered during the data collection process and some critical reflections on this process.

There were two chief problems I confronted in the course of the data collection. The first one was related to transportation and accommodation. Before embarking on the data collection, I felt that transportation and accommodation would not be a problem, since I knew the facilities of the area. However, although they did not cause a problem in the coastal location, I was faced with transportation problems at the lakeside site as soon as I started to collect data. It was difficult to reach the place on some days because of the weather. As the area is very high and it was winter, snows and blizzards were inevitable. In order to avoid this obstacle, I decided

to stay in the area during the course of the data collection despite the costly accommodation. What I have learned from this experience is that I should have taken into account the climate conditions before going to that region. It would have been more convenient if I had gone there during the late spring because of the more suitable weather conditions.

Time constrains was the second problem I encountered. It was my intention to test all the children during a two-month period. Two months seemed enough time to test eighty children even though this meant a fair amount of rushing to meet to self-imposed deadline. However, when I conducted the fieldwork, I realised that I had not taken into account the official holidays which would last ten days. Fortunately, I managed to overcome this barrier which would have stopped me from completing the data collection, by requesting an extra two weeks from the relevant officials.

Besides these problems, there were two critical reflections I had with regard to the use of the methods.

The first one was related to the picture drawing test. After completing the drawing, I did not interview each child about his/her picture. That is, they did not have an opportunity to reveal their awareness of the feature by discussing what they had drawn. Therefore, the deficiency inhibited me from judging the children's ideas about the *colour* of the feature, because the literature suggests that the colour children use may not reflect what they think. However, the children's ideas about the colour of the features were explored via interview and the group working method to offset this deficiency.

The second one was related to the inclusion of some irrelevant questions. In the interview method, I asked some irrelevant questions which were nothing more than time consuming. These questions were: *When did it [the name of the feature] begin? Has there always been a lake, a river and the sea?* and *Was it* [the name of the feature] *there when you were born?* All these questions aimed to reveal children's ideas about the history of the features. What I learned from this experience was that, as Bell (1993) indicated, a researcher needs to remove any question that is not directly associated with the research questions in order to avoid wasting time.

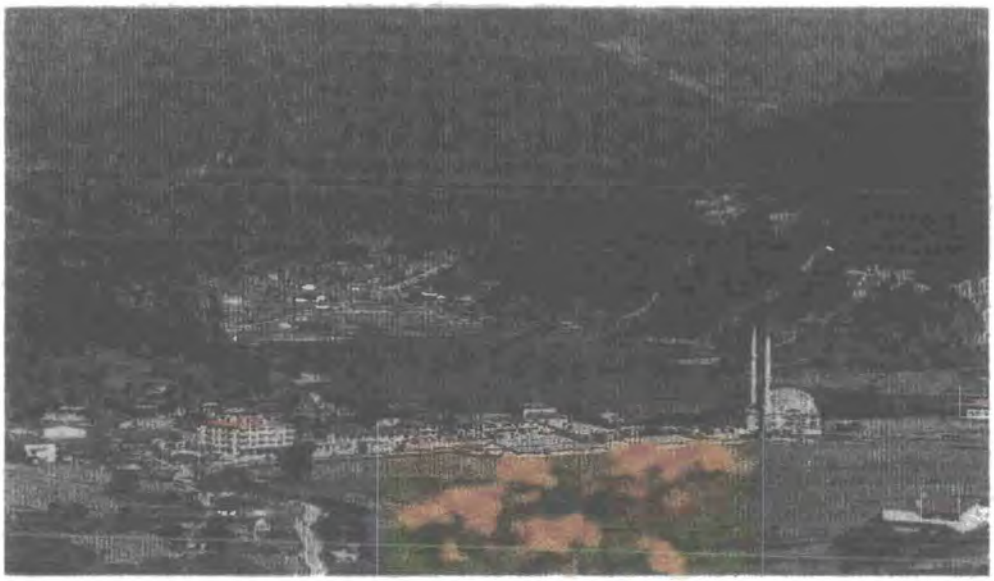
Appendices

APPENDIX A

Picture 1a. The photograph depicting the sea. It was presented the children in the picture recognition test.

Picture 1b. The photograph depicting the sea. It was presented the children in the picture recognition test.

Picture 2a. The photograph depicting a lake. It was presented the children in the picture recognition test.



Picture 2b. The photograph depicting a lake. It was presented the children in the picture recognition test.

Picture 3a. The photograph depicting a river. It was presented the children in the picture recognition test.

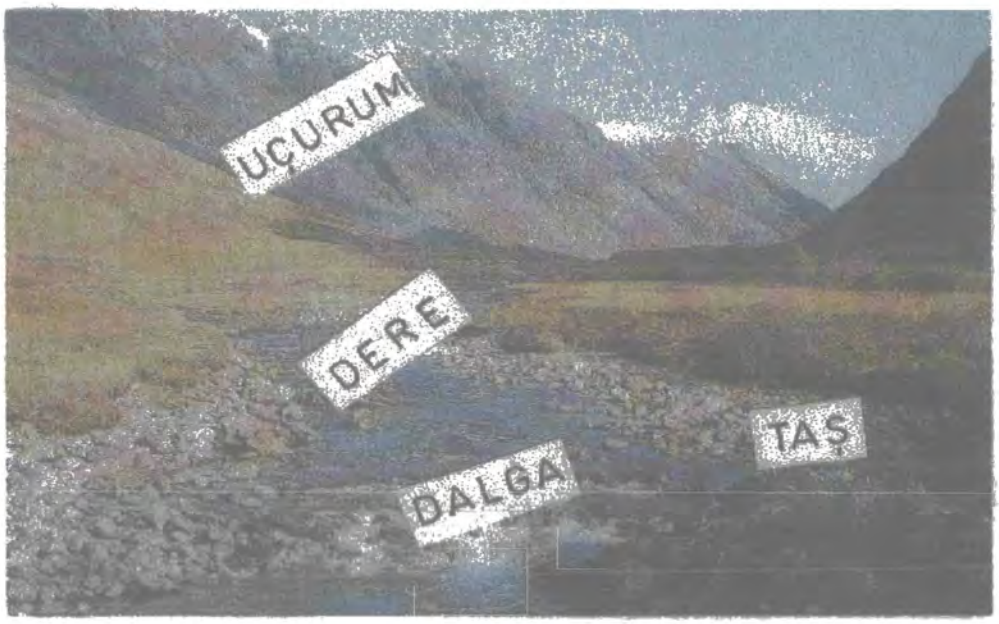
Picture 3b. The photograph depicting a river. It was presented the children in the picture recognition test.

APPENDIX B

An example of the children's responses in connection with the labelling method (Pupil 26, Lakeside Location).

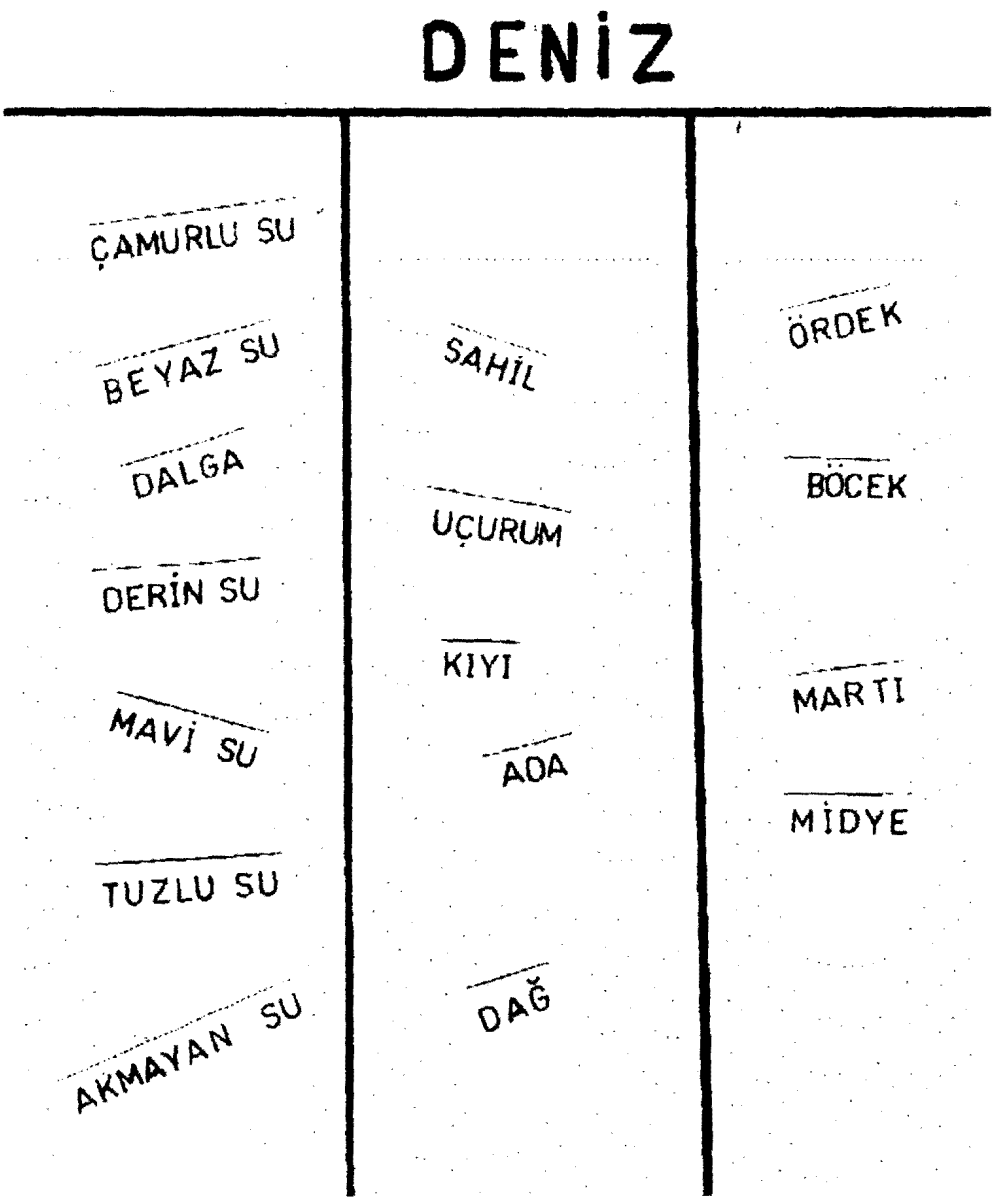
An example of the children's responses in connection with the labelling method). (Pupil 37, Coastal Location

An example of the children's responses in connection with the labelling method (Pupil 20, Coastal Location).



APPENDIX C

An example of the children's responses in connection with the group working method (Pupils 13, 33 and 34, Coastal Location).

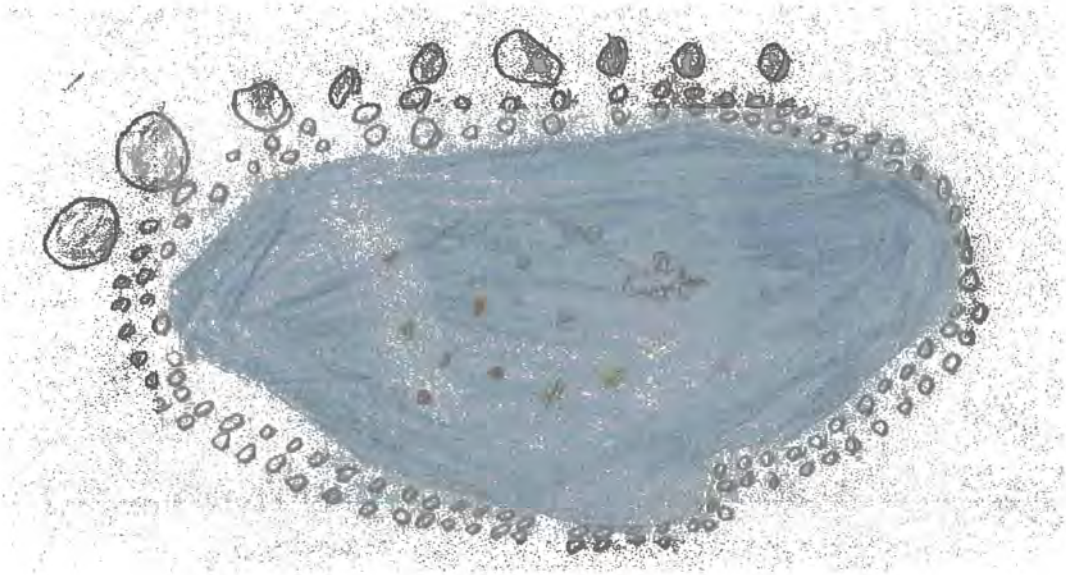


APPENDIX D

An example of the children's drawings of the sea which is considered as correct (Pupil 21, Coastal Location).

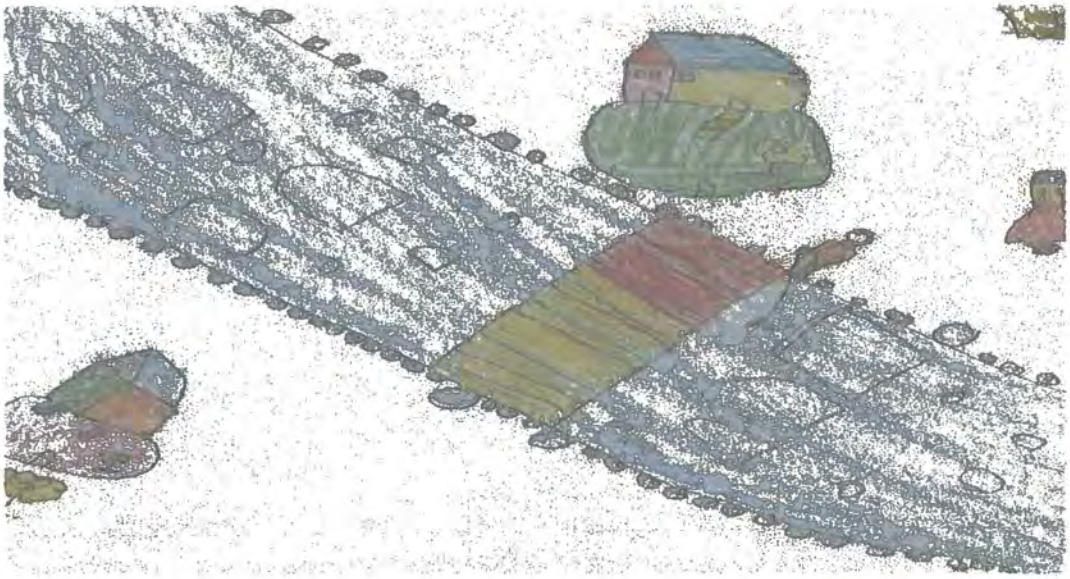
An example of the children's drawings of the sea which is considered as wrong (Pupil 18, Lakeside Location).

An example of the children's drawings of a lake which is considered as correct (Pupil 29, Lakeside Location).



An example of the children's drawings of a lake which is considered as wrong (Pupil 25, Coastal Location).

An example of the children's drawings of a river which is considered as correct (Pupil 30, Lakeside Location).



An example of the children's drawings of a river which is considered as wrong (Pupil 32, Coastal Location).

References

REFERENCES

Alschuler, R.H. and Hattwick, L.B.W. (1969) *Painting and personality: A study of young children.* Chicago: University of Chicago Press.

Ault, C.R. (1984) The everyday perspective and exceedingly unobvious meaning. *Journal of Geological Education*, 32, 89-91.

Bale, J. (1987) *Geography in the primary school.* London: Routledge and Kegan Paul.

Banks, D.L. (1975) *The Development of Some Concepts Involved in the Teaching of Environmental Studies to Children of 7-11 years of Age.* Sheffield University. M.A Thesis.

Baumann, A.S; Bloomfield, A. and Roughton L. (1997) *Becoming a secondary school teacher.* London: Hodder and Stoughton.

Bayliss, D.G. and Renwick, T.M. (1966) Photograph study in a junior school. *Geography*, 51, 322-329.

Bell, J. (1993) *Doing your research project.* Buckingham: Open University Press
Bernstain, B (1975) *Class, codes, and control.* London: Routledge and Kegan Paul.

Bezzi, A. (1989) Geology and society: A survey on pupils' ideas as an instance of a broader prospect for educational research in earth science. Paper presented at the 28th International Geological Congress, Washington , DC.

Bonnes, M. and Scchiarolly, G. (1995) *Environmental psychology.* London: SAGE Publications.

Bower, T.G.R. and Wishart, J.G (1972) The effects of motor skill on object permanence. *Cognition,* 1, 47-55.

Bruner, J.S (1960) *The process of education.* Mass: Harvard University Press.

Bruner, J.S (1973) *Beyond the information given.* London: George and Unwin.

Bryand, P.E. (1974) *Perception and understanding in young children.* New York: Basic Books.

Chambers, B. (1998) Children's ideas about the environment. In Scoffham (ed.) *Primary Sources.* Sheffield, The Geographical Association: Thanet Press.

Coolican, H. (1994) *Research methods and statistics in psychology.* London: Hodder and Stoughton.

Court, E. (1992) Researching social influences in the drawings of rural Kenyan children. In Thistlewood, D. (ed.) *Drawing Research and Development.* Harlow: Longman.

Dolgin, K.G. and Behrend, D.A. (1984) Children's knowledge about animates and inanimates. *Child Development,* 55, 166-1650.

Donaldson, M. (1978) *Children's minds.* London: Fontana press.

Driver, R. and Easley, J. (1978) Pupils and paradigms: A review of the literature related to concept development in adolescent science students. *Studies in Science education*, 5, 61-84.

Driver, R. (1983) *The pupil as a scientist*. St Edmunds: St Edmunsbury Press.

Erickson, G.L. (1979) Children's conceptions of heat and temperature. *Science Education,* 63 (2), 221-230.

Eyres, M. and Garner, W. (1998) Children's ideas about landscapes. In Scoffham (ed.) *Primary Sources*. Sheffield, The Geographical Association: Thanet Press.

Fife-Schaw, C. (1995) Surveys and sampling issues. In Breakwell, G.M; Hammond, S. and Fife-Schaw, C. (ed.) *Research Methods in Psychology*. London: Sage Publications.

Freeman, N.L. (1980) *Strategies of representation in young children*. London: Academic Press.

Gagne, R.M. (1966) The learning of principles. In Klausmeier, H.J. and Harris, C.W. (ed.) *The Learning of Principles*. New York: Academic Press.

Gagne, R.M (1971) *The Conditions of learning*. New York: Holt, Rinehard and Winston.

Gagne, R. (1997) *The conditions of leaning*. London: Holt, Rinehart and Winston.

Gall, D.M; Bory, R.W. and Gall, P.J. (1996) *Educational research*. USA: Longman.

Geber, A.B. (1977) Introduction: on knowing. In Geber, A.B. (ed.) *Piaget and Knowing*. London: Routledge and Kegan Paul.

Gelmen, A.S. and Kremer, E.K, (1991) Understanding natural cause: Children's explanations of how objects and their properties originate. *Child Development*, 62, 396-414.

Gilmartin, P. and Patton, J.C. (1984) Comparing the sexes spatial abilities: Map use skills. *Annals of the Association of American Geographers*, 74, 605-619.

Gilmartin, P. (1986) Maps, mental imaginary and gender in the recall of geographic information. *The American Cartographer*, 13, 335-344.

Golomb, C. (1992) *The child's creation of a pictorial world.* Berkely: University of California Press.

Goodey, B. (1973) *Perceptions of the environment.* Centre for Urban and Regional Studies: University of Birmingham.

Goodnow, J. (1970) Cultural Variations in Cognitive Skills. *Cognitive Studies*, 11 (2), 242-257.

Graves, N.J. (1975) *Geography in education.* London: Heinemann Educational Books Ltd.

Graves, N.J.(1982) *Geography teaching.* Longman/The UNESCO Press.

Hall, D. (1976) *Geography and the geography teacher.* London: Gorge Allen and Unwin LTD.

Harlen, W. (1993) *Teaching and learning primary science*. London: Paul Chapman.

Harris, L.J. (1981) Sex-related variations in spatial skill. In Liben, L; Patterson, A.H. and Newcombe, N. (Ed.) *Spatial Representation and Behaviour across the life span.* Academic Press: New York.

Harwood, D. and Jackson, P. (1993) Why did they build this hill so steep? Problems of assessing primary children's understanding of physical landscape features in the context of the UK National Curriculum. *Geographic and Environmental Education,* 12 (2), 64-79.

Harwood, D. and McShane, J. (1996) Young children's understanding of nested hierarchies of place relationships. International Research on Geographical and Environmental Education, 5 (1), 3-29.

Hart, R. (1979) *Children's experience of place.* Irvington: New York.

Harvey, M.R. (1990) The relationship between children's experiences with vegetation on school grounds and their environmental attitudes. *Journal of Environmental Education,* 21 (2), 9-15.

Henrie, R. L; Aron, R.H; Nelson, B.D. and Poole, D.A.(1997) Gender-related knowledge variations within geography. *Sex Roles,* 36 (9), 605-23).

Horovitz, B.L; Lewis, H. and Luca, M. (1973) *Understanding children's art for better teaching.* Columbus: Charles E. Merrill Publishing Company.

Jahoda, G. (1963) The development of children's ideas about country and nationality. *British Journal of Educational Psychology,* 33, 47-60.

Jervis, R. (1984) The acquisition of some geographical concepts by schoolchildren. Manchester University. PhD Thesis.

Kaminske, V. (1997) Geographical concepts: Their complexity and their grading. *International Research in Geographical and Environmental Education*, 16 (1), 4-19.

Keating, D.P. (1976) *Intellectual talent: Research and development*. Baltimore: John Hopkins University Press.

Keliher, V. (1997) Children's perception of nature. *International research in Geographical and Environmental Education,* 6 (3), 240-243.

Kellogg, R. (1970) *Analysing children's art*. Palo Alto: National Press Books

Kirby, F.D. and Shelds, F. (1972) Modification of arithmetic response rate and attending behaviour in a seventh-grade student. *Journal of Applied Behaviour Analysis,* 5, 79-84.

Klausmeier, J.H; Ghatala, S.E. and Frayer, A. D. (1974) *Conceptual learning and development.* New York: Academic Press, Inc.

Klein, A. C. (1982) Children's concepts of the earth and the sun: A cross cultural study. *Science Education*, 65 (1), 95-107.

Lunnon, A.J. (1969) *The understanding of certain geographical concepts by primary school children.* University of Birmingham. M.Ed. Thesis.

Maccoby, E.E and Jacklin, C.N. (1974) *The psychology of sex difference.* Stanford, California: Stanford University Press.

Marsden, B. (1976) *Geography 11-16.* London: David Fulton Publishers.

Marsden, B. (1995) *Geography 11-16.* London: David Fulton Publishers.

Martin, F. (1995) *Teaching early years geography.* Cambridge: Chris Kington Publishing.

Matthews, M.H. (1984) Cognitive mapping abilities of young girls and boys. *Geography,* 69, 327-36.

Matthews, M.H. (1986) Gender, graphicacy and geography. *Educational Review*, 38, 259-71.

Matthews, M.H. (1987) Gender, home range and environmental cognition. *Transactions of the Institute of British Geographers*, New Series, 12, 43-56.

Matthews, M.H (1992) *Making sense of place*. Hertfordshire: Harvester Wheatsheaf.

May, T. (1998) Student research project 3: Children's ideas about rivers. *Primary Geographer*, 25, 12-13.

McAulay, J. D. (1966) Second grade children's growth in comprehension of geographic understandings. *Journal of Geography*, (65) 33-37.

McDonald, R.B. and Bethel, L.J (1996) *A comparison of coastal and inland residents' knowledge of marine organisms and their feeding relationships.* Technical Report, Eric No: ED371938

McGlone, J. (1980) Sex differences in human brain asymmetry: Critical survey. *The Behavioural and Brain Science,* 3, 215-27.

Medin, D.L and Ross, B.H. (1997) *Cognitive psychology.* Fort Worth: Harcourt Brace College Publishers.

Milburn, D. (1972) Children's vocabulary. In N.J. Graves (ed.) *New Movements in the Study of Teaching of Geography.* London: Temple Smith.

Morgan, D.L (1988) *Focus groups as qualitative research.* Newbury Park: Sage Publications.

Nash, P. (1983) The effects of teaching upon children's concepts relating to rivers. University of Warwick. BEd Thesis.

Nussbaum, J., Novak, J., D. (1976) An Assessment of children's concepts of the earth utilizing structured interviews. *Science Education,* 60 (4), 535-550.

Nussbaum, J. and Novick, S. (1982) Alternative frameworks, conceptual conflict and accommodation. *Instructional Science,* 11, 183-200.

Osborne, R. J. and Gilbert, J.K. (1979) A technique for exploring students' views of the world. *Physics Education,* 15, 376-79.

Osborne, R.R. and Cosgrove, M.M. (1983) Children's conceptions of the changes of state of water. *Journal of Research in Science Teaching*, 20 (9), 825-838.

Osborne, R. and Wittrock, M.C. (1985) The generative learning model. *Studies in Science Education*, 12, 59-87.

Palmer, J. (1993) From santa claus to sustainability: Emergent understanding of concepts and issues in environmental science. *International Journal of Science Education*, 15 (5), 487-495.

Palmer, J. (1994) A sense of place: Geography / Environmental education in the early years. In C Aubrey (ed.) *The Role of Subject Knowledge in the Early Years of Schooling*. London: The Falmer Press

Palmer, J.A; Suggate, J. and Matthews, J. (1996) Environmental cognition: early ideas and misconceptions at the ages of four and six. *Environmental Education Research*, 2 (3), 301-329.

Piaget, J. (1929) *The child's conception of the world.* London: Routledge and Kegan Paul.

Piaget, J. (1930) *The child's conception of the causality.* London: Routledge and Kegan Paul.

Piaget, J. (1969) *The child's conception of physical causality.* Totowa: NJ, Littlefield, Adams.

Pines, L.A. and West, L.H. (1983) *A framework for conceptual change with special reference to misconceptions*. Cornell University.

Platten, L. (1995a) Taking Geography: an investigation into young children's understanding of geographical terms, Part 1. *International Journal of Early Years Education*, 3 (1), 74-91.

Platten, L. (1995b) Taking Geography: An investigation into young children's understanding of geographical terms, Part 2. *International Journal of Early Years Education*, 3 (1), 74-91.

Quillen, I.J. and Hanna, L.A. (1961) *Education for social competence*. Chicago: Scott Foresman.

Redford, G.M. (1976) An investigation into the understanding of selected concepts used in geography by young children between the ages of 5-11 years with reference to the effects of the physical environment on the understanding of concepts. London Institute of Education. M.Phil. Thesis.

Reber, A.S. (1995) *Dictionary of* psychology. London: Penguin Group.

Robertson, M.E. (1994) The Influence of place on adolescent's response to the environmental stimuli. *International Research in Geographic and Environmental Education*, 13 (2), 3-21.

Ross, K.E.K. and Shuell, T.J. (1993) Children's beliefs about earthquakes. *Science Education*, 77 (2), 190-205.

Russell, T; Bell, D; Longden, K. and McGuigan, L. (1993) Rocks, soil and weather. *Primary Space Project*. London: Liverpool University Press.

Salmon, P. (1992) *Achieving a PhD.* Staffordshire: Trentham Books Limited.

Samarapungavan, A; Vosniadou, S. and Brewer, W, F. (1996) Mental models of the earth, sun, and moon: Indian children's cosmologies. *Cognitive Development*, 11,491-521.

Schibeci, R and Sorensen, I. (1983) Elementary school children's perceptions of scientists. *School Science and Mathematics*, 83(1), 14-20.

Sheridan, J.M. (1968) Children's awareness of physical geography. *The Journal of Geography*, 67, 82-86.

Skinner, B.F. (1938) *The behaviour of organism.* New York: Appleton.

Smith, F. (1965) Natural phenomena as explained by children. *The Journal of Educational Research*, 59 (3), 137-140.

Strenberg, R. J. (1996) *Cognitive psychology.* Fort Worth: Harcourt Brace & Company.

Stepans, J. and Kuehn, C. (1985) Children's conceptions of the weather. *Science and Children,* September.

Tasker, C.R. (1981) Children's views and classroom experience. *Australian Science Teachers Journal*, 27 (3), 33-37.

Thompson, E.G; Harris, L.J. and Mann, I. (1980) Relationships among sex: Measures of cognitive complexity and performance on spatial tasks in college students. *British Journal of Psychology*, 73, 323-31.

Wadsworth, B.J. (1971) *Piaget's theory of cognitive development.* New York: Longman.

Watts, S. (1998) Primary geography for the 21st century. In Scoffham (ed.) *Primary Sources.* Sheffield, The Geographical Association: Thanet Press.

Werner, E.E (1972) Infants around the world. *Journal of Cross-cultural Psychology,* l3 (2) 111-34.

Wiegand, P. (1992) *Places in the primary school: Knowledge and understanding of places at Key Stages 1 and 2.* London: The Falmer Press.

Wiegand, P. (1993) *Children and primary geography.* London: Cassell

Wiegand, P. (1996) Interviews. In P. Williams (ed.) *Understanding geographical and environmental education.* London: Cassell.

Wilson, P. and Goodwin, M. (1981) How do twelve and ten-year-old students perceive rivers?. *Geographical Education,* 4, 5-16.

Wilson, P. and Widt, L. (1982) How do 14-year-old pupils 'see' desert landscape. *Teaching Geography,* 8 (1), 9-12.

Wood, D. (1995) *How children think and learn.* Oxford: Blackwell Publishers Ldt.

Vosniadou, S. (1991) Designing curricula for conceptual restructuring: Lessons from the study of knowledge acquisition in astronomy. *Journal of Curriculum Studies,* 23 (3), 219-237.

Vygotsky, L.S. (1962) *Thought and Language*. Translated by: Hanfman, E. and Vakar, G. Cambridge: The M.I.T. Press.