

**AN EVALUATION OF CASE STUDY
TEACHING MATERIALS ON HAZARDS,
BASED ON THE CURRENT AIMS OF
GEOGRAPHICAL EDUCATION**

HALF-THESIS

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DECLARATION

I declare that this dissertation describes my original work and has not been submitted for a degree at any other university.

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ABSTRACT

Hazards are an integral part of people-environment relationships. The impact of hazards, locally and globally has become increasingly more severe, particularly in the previous two decades. This is largely as a result of unwise human intervention in natural systems. The study of hazards at secondary school level affords valuable opportunities for learning about people-environment issues. This, in turn, can promote a greater awareness of environmental problems.

One of the most important current aims of Geographical Education is the development of critical thinking skills in pupils. Such skills are vital for equipping pupils with the necessary tools to understand and participate in solving the world's increasing human and environmental problems. The development of a critical faculty in pupils is best achieved by the use of learner-based, participatory teaching strategies where pupils are involved in problem solving activities.

Research has shown that British and South African Geography curricula reflect current thinking in Geographical Education and learning theory. The 1992 Junior Secondary Geography Syllabus, in line with these trends, includes a section for study on hazards. Hazards are presented primarily as case studies in modern Geographical texts, which is seen as one of the most effective ways of teaching hazards. Research, however, suggests that South African textbooks have certain shortcomings, notwithstanding the importance placed on textbooks by teachers in this country.

This study investigated the extent to which case study teaching materials on hazards are optimising opportunities available for effective learning, within an Environmental Paradigm. An evaluation methodology, which is believed to have value for use by other researchers, was developed to suit the specific requirements of the study.

The study findings reveal a poor realisation of the current aims of Geographical Education and learning theory, regarding the South African teaching materials. Recommendations are made for improvements in the development and use of local case study teaching materials. Guidelines for the development of local materials are provided from case studies in British texts and from methods developed by the researcher.

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CHAPTER ONE
INTRODUCTION

1.1 BACKGROUND TO THE STUDY

Hazards fall at the interface of people-environment relationships (Burton, et al., 1978; Paterson, 1985). In many cases hazard impacts have been exacerbated by thoughtless human intervention in the natural environment (Paterson, 1985; Jones, 1991). On a global scale, Stehens (1986:254) observes that "the first half of the 1980's seems to have witnessed a range of environmental catastrophes well nigh unmatched in any period of recent history." These global trends led to the United Nations declaring the 1990's to be the "International Decade for Natural Disaster Reduction" (Jones, 1991). The term "mega-disasters" has been used to describe the potential hazard impacts of the future (Paterson, 1985). The devastation associated with Hurricane Andrew in 1992 and with the catastrophic Indian earthquake in 1993 bears evidence to this warning.

The South African scenario reflects global trends. Huntley, et al., (1989:36) describe the 1980's in South Africa as:

The decade the environment hit back ... never before in recorded history has the country endured such a succession of droughts, floods, hailstorms, veld fires and locust outbreaks.

It is suggested that the severity of these hazard impacts has been aggravated by careless environmental management and planning (Huntley, et al., 1989). The continuation of droughts and floods in parts of South Africa into the 1990's provides an indication of the increasing severity of hazard impacts in this country. In order to cope with such potential hazard impacts, Lindesay (cited in Hartley, 1993) has suggested a forum or committee to monitor natural disasters in South Africa.

The teaching and learning about hazards, therefore, provides

tremendous opportunities to examine numerous people-environment issues and associated planning, management and mitigation measures (Shorthouse, 1984). This in turn will promote a greater awareness of environmental problems (Parker & Harding, 1979). The valuable opportunities which hazards present for Environmental Education cannot be underestimated, seen against the background of dramatically increasing environmental problems, both globally and locally. Learning about hazards is also seen to provide a meaningful bridge between Geographical understanding and real-life circumstances (Oliver, 1975).

Recent research has revealed a trend towards more environmentally-based Geography curricula. Van Harmelen (1991) asserts that the South African 1985 Revised Syllabus and the 1993 Draft Core Syllabus are both underpinned by the Environmental Paradigm. Similarly, the 1991 British National Curriculum places emphasis on Environmental Geography, as did the earlier Geography 16-19 Project in Britain (Boardman & McPartland, 1993b). Furthermore the International Charter on Geographical Education (1992) stresses the importance of examining people-environment relationships.

In addition to the importance placed on an environmental perspective, recent Geography syllabi in South Africa are essentially learner-centred and allow for participatory-based teaching strategies (van Harmelen, 1991).

These recent trends in Geographical Education are reflected in the 1992 South African Junior Secondary Geography Syllabus (hereafter referred to as the 1992 Syllabus). In keeping with the development towards an environmentally based Geography, a section on hazards has been included for study in the std. 7 syllabus.

There has been a development, in Britain especially, towards the greater use of case studies in Geographical Education. Texts containing case studies of hazards, in particular, exemplify much of current thinking in Geographical Education. Such texts, e.g., Musgrove (1988) and Porter (1989) include case studies which

provide opportunities for maximum pupil participation and for a variety of problem-solving activities. It has been suggested that case studies should be approached from a problem-based perspective, encouraging the development of critical thinking skills (Stimson, 1968; Bloomfield, cited in Marsden, 1976). This trend towards the greater use of case studies is evidenced in the inclusion of numerous case studies of hazards in South African textbooks for std. 7 Geography, e.g., Earle et al., (1992); Swanevelder et al., (1992) and Carr et al., (1992).

Although the 1992 Syllabus does allow for the implementation of participatory-based strategies, research has shown that most teaching in South African schools is not learner-centred, but is largely textbook-based (Ledger, 1977; Ballantyne, 1986). Studies and reports by Hattingh (1971), Diepeveen (1982) and Mophiring (1983) highlight the extensive use of textbooks by teachers in the South African educational system. However, due to a lack of training, teachers often do not have the necessary skills to teach effectively and use the textbook in place of the syllabus (Diepeveen, 1982). The syllabus is therefore interpreted through the textbook. Furthermore, inadequacies have been revealed in South African textbooks (du Preez, 1983; Dean, et al., 1983; Langhan, 1990; Drummond & Paterson, 1991; Rulashe, research in progress).

In order to facilitate effective learning in the classroom, textbooks should reflect current thinking in Geographical Education and modern learning theory (Nightingale, 1974). Case studies of hazards, in particular, present tremendous opportunities for using modern teaching strategies and for furthering the current aims of Geographical Education.

1.2 PROBLEM IDENTIFICATION

In the light of the foregoing, the researcher has demarcated the following problem area:

The extent to which case study teaching materials on hazards, currently available in South Africa, optimize the opportunities for:

- (a) effective teaching and learning;
- (b) environmental Education.

1.3 THE PURPOSE OF THE STUDY

In the light of an exploration of the current aims of Geographical Education, current learning theory and research in the field of textbook evaluation, the study will provide a theoretical underpinning of:

- (a) hazards and their educational value;
- (b) the methodology and presentation of case studies in Geographical Education.

In so doing, the study aims:

- (a) to examine and evaluate approaches used in educational evaluation, in particular those used in materials evaluation, in order to develop an appropriate methodology to evaluate case studies used in Geographical Education.
- (b) to conduct an evaluation of case study teaching materials currently available in South African and British texts, specifically related to hazards.

1.4 THE STRUCTURE OF THE STUDY

Chapter Two provides a critical review of current thinking and research pertinent to this study. A critical overview of the historical development of case studies in Geographical Education constitutes a part of original research and is included in Chapter Two as it is felt that it provides an integral part of the background to the study.

Chapter Three provides an examination and evaluation of models and approaches in educational evaluation and educational materials evaluation, in order to extrapolate and to develop an appropriate methodology for the present study.

Chapter Four sets out the evaluation methodology applied in this study, based on the examination in the previous chapter.

Chapter Five provides the results of the evaluation.

Chapter Six presents the conclusions and recommendations arising from the research.

CHAPTER TWO
LITERATURE REVIEW

2.1 INTRODUCTION

Research by Ledger (1977); Ballantyne (1986) and van Harmelen (1991) has revealed that the teaching of Geography in South Africa is to a large extent teacher-centred, based on the acquisition of facts, and relies heavily on the use of the textbook. The textbook, in particular, is seen as possibly the most important tool by teachers in South Africa (Hatting, 1971; Diepeveen, 1982; Mophiring, 1983).

Shortcomings, however, have been found with regard to Geography textbooks in South Africa. Research by Burton (1986); van Jaarsveld (1988) and Schurmann (1992) has pointed to the difficulty experienced by many pupils in comprehending three-dimensional abstractions in mapwork, meteorology and climatology, as presented in teaching materials. Their research clearly showed the inability of the materials to present difficult abstractions in a clear and understandable form. Langan (1990) and Rulashe (research in progress), too, have revealed Geography textbook deficiencies with regard to their poor comprehension by second language speakers. A further weakness of Geography textbooks in South Africa was revealed by Drummond & Paterson (1991) with regard to the heavy author bias in selected texts. Furthermore, a survey completed in 1986, concluded that Geography teaching in South Africa was hampered to some extent by the use of inadequate textbooks (Hattingh, 1971).

In spite of these inadequacies, it would seem that the textbook continues to be an essential tool in the teaching of Geography in South Africa (Diepeveen, 1982). Against this background the researcher has isolated a need for what is believed to be a new field of textbook evaluation in South Africa: the evaluation of pupil applications and activities based on the teaching materials. The part of the Geography curriculum chosen for the evaluation was

the section on hazards, which is a new topic for study in the 1992 Syllabus. Oliver (1975) emphasises the opportunities which hazards present for enhancing pupils' understanding of people-environment problems. In addition, the study of hazards is seen to provide a meaningful bridge between understanding and real-life circumstances (Parker & Harding, 1979).

A trend in Geographical Education, locally and overseas, is the use of case study teaching materials. British texts, in particular exemplify this trend, e.g. Law & Smith (1987); Musgrove (1988) and Porter (1989). Case studies in these texts contain pupil-centred, problem-based applications, which are representative of modern learning theory. Current learning theory places importance on learner-centred teaching/learning activities (Clements & Battista, 1990). South African texts, too, present a number of case studies of hazards, e.g. Earle, et al., (1992); Carr et al., (1992) and Swanevelder, et al., (1992). The researcher intends to evaluate case studies of hazards in South African texts, in order to ascertain whether they are optimising the opportunities for Environmental Education and for effective teaching and learning.

In the light of the foregoing, this chapter will discuss the following aspects:

- (i) Hazards and their educational value.
- (ii) The use of case studies in Geographical Education.
- (iii) Current thinking in Geography Education, in relation to modern learning theory, with reference to South African and British syllabi.
- (iv) Previous research relevant to this study in the field of textbooks, both locally and overseas.

2.2 NATURAL AND ENVIRONMENTAL HAZARDS

2.2.1 DEFINITIONS

Definitional problems exist with the term "natural hazard". Whittow

(1980:19) defines a hazard as "a perceived natural event which threatens both life and property". Oliver (1975:341) elaborates further:

Natural hazards are extreme geophysical events greatly exceeding normal human expectations in terms of their magnitude or frequency, and causing major human hardship with significant material damage to man and his works and possible loss of life.

White (1974:3) emphasises the fact that "no natural hazard exists apart from human adjustment to it", and his definition (1974:4) reflects this view:

A natural hazard is defined as an interaction of people and nature governed by the coexistent state of adjustment in the human use system and the state of nature in the natural events system.

These definitions view hazards as "natural" or geophysical in origin, but many authors, for example Whittow (1980) and Paterson (1985), distinguish in some way or another between natural and quasi-natural (human-induced or modified) hazards. Paterson (1985:23) provides a clear distinction between the two:

Natural hazards arise through the action of geophysical and biological processes. Environmental hazards involve the interaction of natural processes with man-induced ones, and bring more widespread, long-term changes affecting environmental quality.

Paterson (1985:24) further qualifies this distinction by pointing out that hazards should rather be seen as "a continuum of hazardous situations encompassing a wide variety of events from the natural to the humanly induced ones."

The "naturalness" of natural disasters has also been questioned by many authors, who emphasise the fact that if man were to be removed from the situation, then in fact there would be no hazards at all (White, 1974; Frazier, 1979; O'Keefe, et al., 1985; Jones, 1991). Jones (1991:34) puts it neatly: "Without people there can be no disasters." Burton, et al. (1978) see the interplay between natural

and human systems producing both opportunities (useful resources) and constraints (hazards) (Fig.2.1). The authors (1978:20) assert that: "It is people who transform the environment into resources and hazards, by using natural features for economic, social and aesthetic purposes."

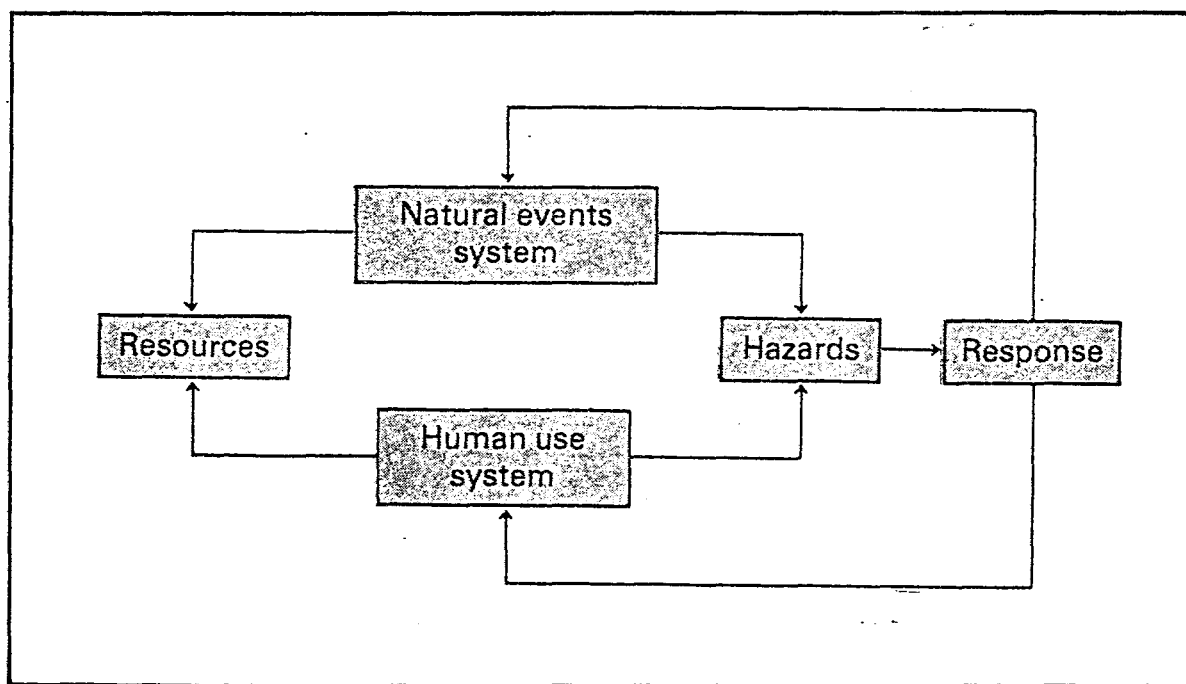


FIGURE 2.1
THE TWO-WAY ASSOCIATION BETWEEN MAN AND ENVIRONMENT,
CREATING BOTH RESOURCES AND HAZARDS
(PATERSON, 1985:23, AFTER BURTON ET AL., 1978)

Sorensen & White (cited in Paterson, 1985) suggest that hazards need not be seen only in terms of constraints or costs, but also in terms of benefits, for example the benefits of human occupancy of the risk area, direct benefits from a disaster (e.g. riverine silt from floods) and the benefits of greater social and community cohesion. Extreme events must not be seen as unmitigated evils, for example many of the disasters bring life-nourishing rains to many regions of the world (Frazier, 1979).

Confusion arises, too, with the use of the terms "hazard" and

"disaster", and the two are used interchangeably and loosely, for example by Friesma, et al., (1979) and Drabek (1988). Some authors (Whittow, 1980; Earle, et al., 1992; Swanevelder, et al., 1992) claim that a disaster is the realisation of the hazard threat. This is only true in part as not all realizations of hazard threats need necessarily result in disasters or catastrophes. Jones (1991) provides a clearer perspective on the distinction between the two, and rather sees a disaster as a relatively infrequent, large scale hazard impact. This extreme nature of disasters is further emphasised by White (1974) and Paterson (1985).

Perhaps it would be better to speak of a range of hazard impacts, ranging from low to high frequency and from low to high magnitude events (Fig. 2.2), where disasters occupy a relatively small part of the entire range. For the purposes of clarity, the term hazard will be used to mean the full range of threats/impacts, both natural and environmental (quasi-natural) and on all scales of magnitude and frequency. The term disaster will be reserved for those high magnitude, low frequency hazard impacts with catastrophic losses (Fig. 2.2).

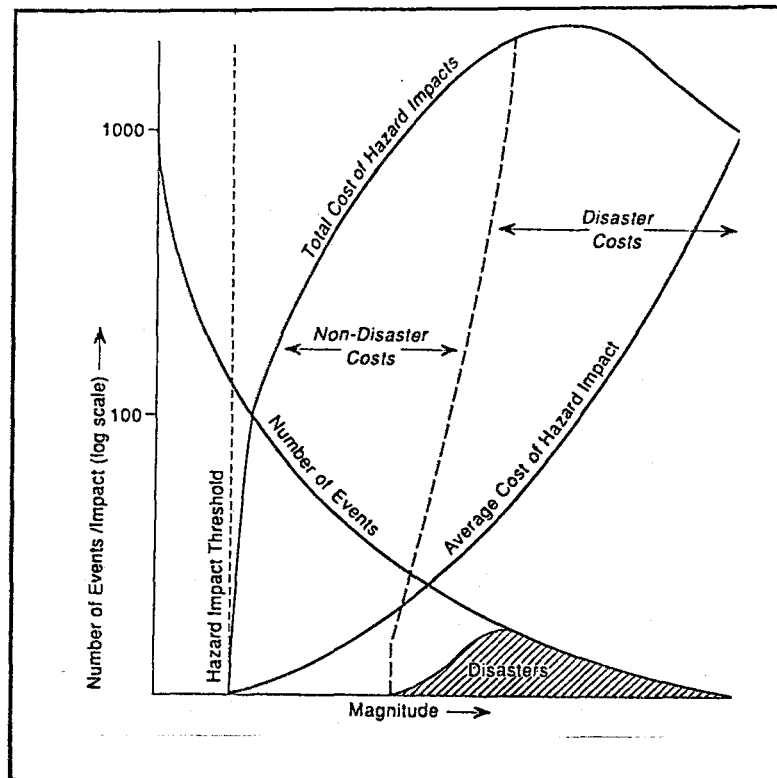


FIGURE 2.2
 HYPOTHETICAL RELATIONSHIP BETWEEN THE MAGNITUDE FREQUENCY
 CHARACTERISTICS OF HAZARD EVENTS AND COSTS
 (JONES, 1991:29)

2.2.2 CLASSIFICATION SCHEMES

Classification schemes of hazards necessarily differ according to the author's definition of a hazard and the purpose of the classification. Parameters which have been used are magnitude, velocity, duration, death toll, financial cost, areal extent and causal agent (Burton, *et al.*, 1978; Whittow, 1980). The most commonly used parameter is causal agent. A classification according to principal causal agent (Table 2.1) by Burton, *et al.* (1978) has been used as a standard by many researchers. Later schemata, however, enlarged on this rather restricted scheme, and encompassed a wider range of hazards, both natural and environmental.

Geophysical		Biological	
Climatic and Meteorological	Geological and Geomorphic	Floral	Faunal
Blizzards and Snow	Avalanches	Fungal Diseases <i>For example:</i>	Bacterial and Viral Diseases <i>For example:</i>
Droughts	Earthquakes	Athlete's foot	Influenza
Floods	Erosion (including soil erosion and shore and beach erosion)	Dutch elm	Malaria
Fog		Wheat stem rust	Typhus
Frost	Landslides	Blister rust	Bubonic plague
Hailstorms	Shifting sand	Infestations <i>For example:</i>	Venereal disease
Heatwaves	Tsunamis	Weeds	Rabies
Hurricanes	Volcanic eruptions	Phreatophytes	Hoof and mouth disease
Lightning Strokes and Fires		Water hyacinth	Tobacco mosaic
Tornadoes		Hay fever	Infestations <i>For example:</i>
		Poison ivy	Rabbits
			Termites
			Locusts
			Grasshoppers
			Venomous animal bites

Whittow (1980) devised a scheme (Fig. 2.3), based on the previous work of Canadian researchers. Hazards are grouped into four classes: natural, quasi-natural, social and man-made. Interestingly, Whittow used two additional variables in the scheme, viz. public perception of the degree of disruption and their

ability to control the event. This resulted in a clustering of hazard types (Fig. 2.3).

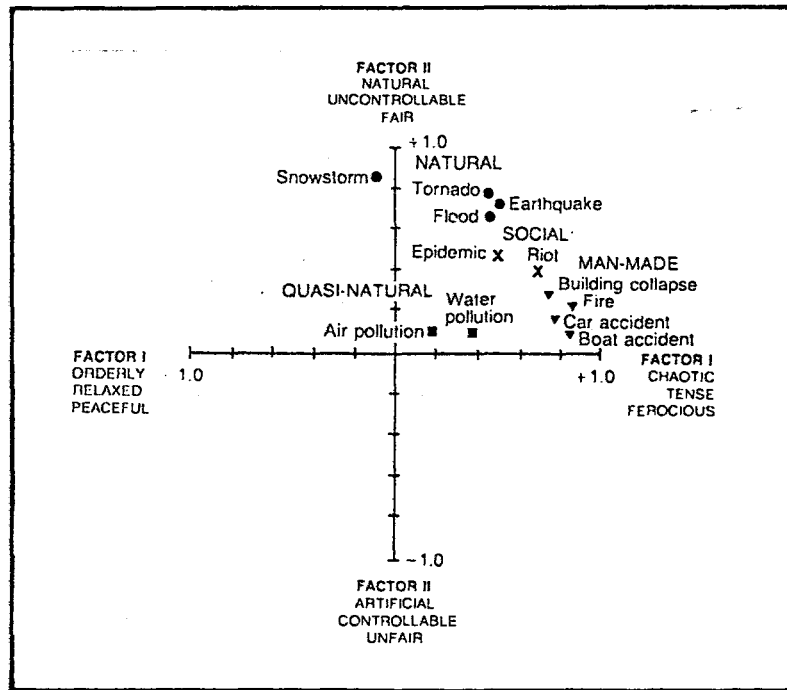


FIGURE 2.3
A CLASSIFICATION OF HAZARDS INTO NATURAL, QUASI-NATURAL,
SOCIAL AND MAN-MADE
(WHITTON, 1980:21, AFTER WAPNER, COHEN & KAPLAN)

Jones (1991) provided a more comprehensive scheme, but without the use of extra variables, as in Whittow's (1980) scheme. The scheme differentiates among three main hazard types: natural, quasi-natural and anthropogenic (Fig. 2.4). One must bear in mind, however, Jones' (1991) advice that hazards should be viewed as a continuum of hazardous situations, and that the arbitrary divisions created by classification schemes are indeed just that, and must not be seen as discrete categories. Therefore flooding, avalanching and ozone depletion (Fig. 2.4) are given as examples which have characteristics of more than one hazard type. The spectrum of hazards in the scheme is comprehensive and will be used as a guide in the subsequent evaluation.

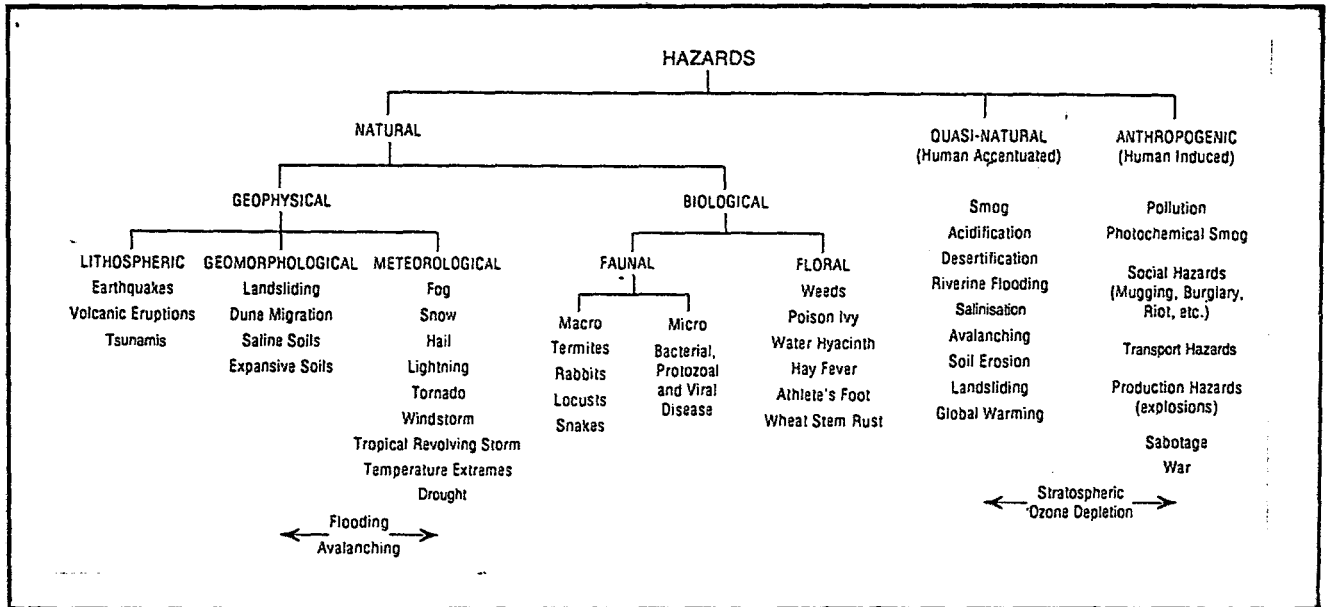


FIGURE 2.4
THE SPECTRUM OF HAZARDS: NATURAL, QUASI-NATURAL
AND ANTHROPOGENIC
(JONES, 1991:35)

2.3 HAZARDS AND THEIR SIGNIFICANCE

2.3.1 GLOBAL IMPACT AND TRENDS

Authors warn of an increasing global toll from extreme hazard events, particularly in the developing world (Burton, *et al.*, 1978; O'Keefe, *et al.*, 1985; Stehbens, 1986; Jones, 1991).

The decades of the 1970s and 1980s have seen unprecedented damage and loss of life from hazard impacts. O'Keefe, *et al.*, (1985) point out that six times as many people died from disasters each year in

the 1970s than in the 1960s.

Stehbens (1986:254) highlights the catastrophes of the 1980s:

The first half of the 1980s seems to have witnessed a range of environmental catastrophes well-nigh unmatched in any period of recent history. Widespread droughts across Africa, Australia and South America; tropical cyclones and flooding in Bangladesh, the Caribbean, Japan and Queensland; earthquakes in Italy, Turkey and China; bushfires in South-Eastern Australia and California exemplify these catastrophes.

These global trends resulted in the United Nations declaring the 1990s to be the "International Decade for Natural Disaster Reduction", stating that:

During the past two decades, natural disasters have been responsible for about 3 million deaths and have affected at least 800 million people through homelessness, disease, serious economic loss and other hardships, including immediate damages in the hundreds of billions of dollars (cited in Jones, 1991:44).

The 1990s have already witnessed disasters of tremendous impact and cost. In 1992, Hurricane Andrew cut a swathe of destruction through the West Indies and the Gulf Coast, causing 20 billion dollars damage and 22 deaths in Florida alone ("Andrew's wrath", 1992). Almost a year later severe flooding in the American Midwest caused damage amounting to 26 billion dollars and 25 deaths ("New flooding threat", 1993). In September 1993 a catastrophic earthquake struck India, claimed to be the worst in 50 years, killing up to 20 000 people and injuring approximately 30 000 more ("Quake toll", 1993). These disasters merely serve as extreme examples: many more local hazard impacts of a lesser scale have been registered in many parts of the world in the 1990s, but have gone largely unnoticed.

Statistics indicate increases in both the number of disasters per year and the annual cost of impacts (Fig. 2.5). Jones (1991:41) explains this trend as a result firstly of better reporting and data collection since the 1980s, but secondly and most importantly as a result of:

the growing vulnerability of human society due to population growth, urbanisation, industrialisation and infrastructure development. This indicates that increased losses from natural hazards are due, in the main, to inadequate adjustment by society rather than the increasing violence of nature.

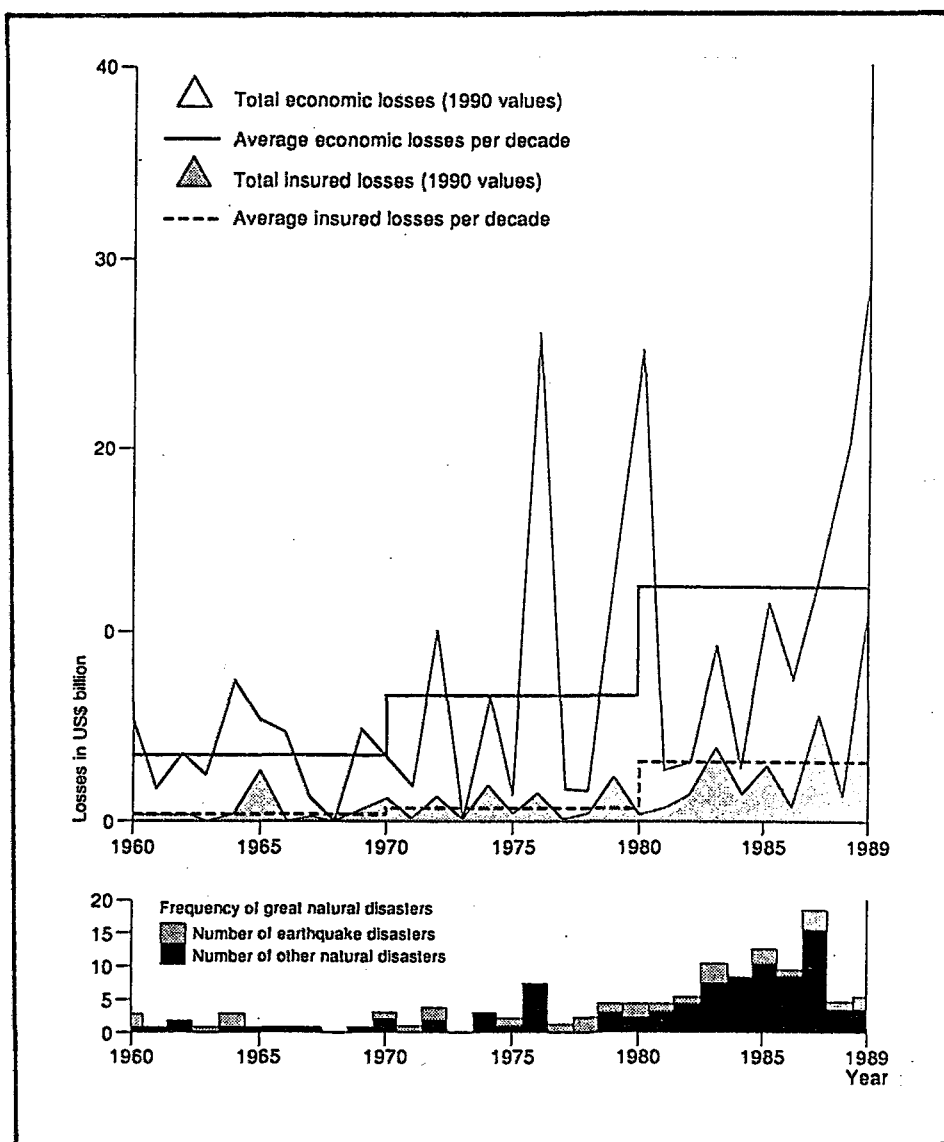


FIGURE 2.5
LOSSES FROM NATURAL DISASTERS, 1960-89
 (JONES, 1991:42)

The increasing severity of hazard impacts is especially noticeable in the developing countries, which are more vulnerable to extremely high proportional losses and deaths (Fig. 2.6 and Table 2.2).

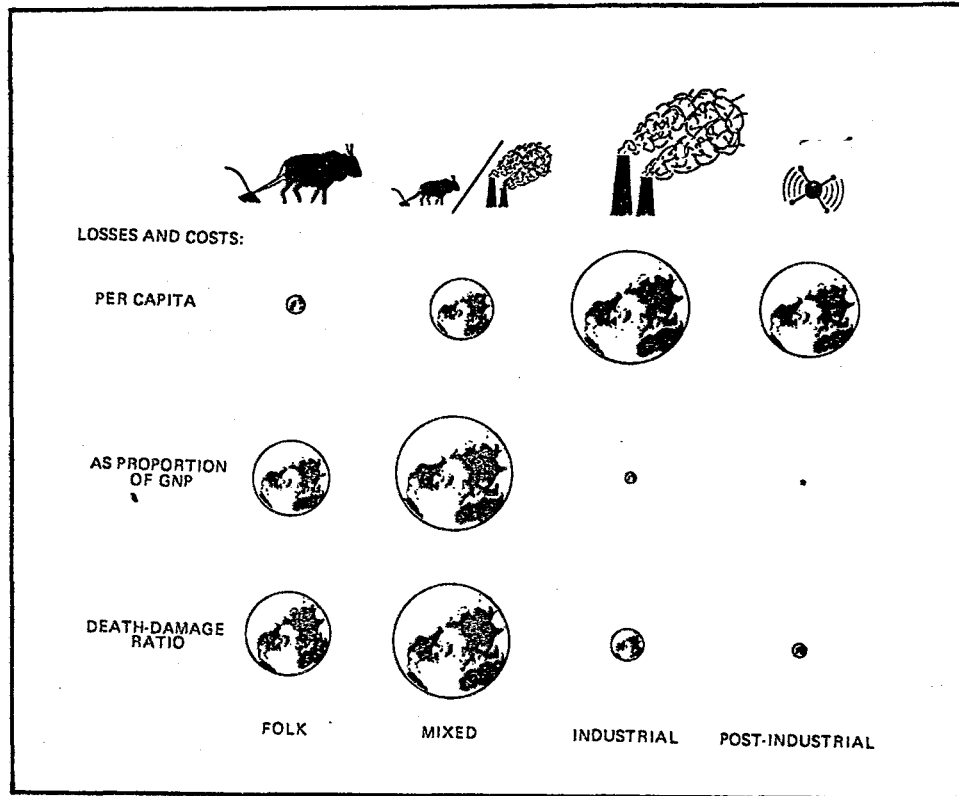


FIGURE 2.6
HAZARDS COSTS, BY SOCIETAL TYPE
(BURTON, ET AL., 1978:221)

TABLE 2.2
FIRST WORLD: THIRD WORLD - AVERAGE ANNUAL LOSSES FROM DISASTERS
(STEBENS, 1986:258, AFTER BERRY & KATES, 1980; FIEN, 1985)

Hazard	Country	Total Pop'n	Pop'n at Risk	Annual Death Rate Per Million People at Risk	Losses and Costs per Capita At Risk			
					Damage Losses (\$US)	Costs of Hazard Loss Reduction(\$US)	Total Costs (\$US)	Total Cost as % of GNP (\$US)
DROUGHT	Tanzania	13	12	40	0.70	0.80	1.50	1.84
	Australia	13	1	0	24.00	19.00	43.00	0.10
FLOOD	Sri Lanka	13	3	5	13.40	1.60	15.00	2.13
	USA	207	25	2	40.00	8.00	48.00	0.11
TROPICAL CYCLONE	Bangladesh	72	10	3,000	3.00	0.40	3.40	0.73
	USA	207	30	2	13.30	1.20	14.50	0.04

Paterson (1985:25) summarises the differential impacts in developing and industrialised countries:

For the developing countries natural disasters are costly in lives and relative wealth. For the industrialised, richer countries, natural disasters result in high property and material losses.

A number of reasons can be cited for this situation: inefficient forecasting organisations, warning systems, evacuation procedures and measures of physical protection. In addition, it is usually the poor, living in extremely poor quality housing, often in precarious locations who are the most vulnerable and suffer the most (Jones, 1991). Developing countries have much higher numbers of people who fall into this category and therefore are more vulnerable to such catastrophes.

It is interesting to note that approximately 90% of all the world's disasters originate in four hazard types: floods (40%); tropical cyclones (20%); earthquakes (15%) and drought (15%). Table 2.3 clearly shows the high occurrences of the first three hazard types mentioned. These figures have significant implications for South Africa, as floods and droughts are the most serious of all hazards in this country (Myburgh, 1989).

TABLE 2.3
NUMBER OF DISASTERS BY NATURAL AGENT, 1947-80
(JONES, 1991:48 FROM SHAH, 1983)

<i>Agent</i>	<i>Number of disasters</i>
Floods	333
Typhoons, hurricanes, cyclones	210
Earthquakes	180
Tornadoes	119
Thunderstorms	37
Snowstorms	32
Heatwaves	25
Coldwaves	14
Volcanoes	18
Landslides	33
Rainstorms	33
Avalanches	12
Tidal waves	7
Fog	3
Frost	2
Sand and dust storms	3
Total	1,061

Predictions for the future seem bleak. Paterson (1985) observes that the term "mega-disasters" has been used to describe potential disasters in the future. It seems inevitable that the scale of the disaster problem will escalate, in the light of increasing numbers and increasing concentrations in hazard susceptible localities, and the poor level of preparedness. In addition to this, the use of more sophisticated technology is likely to increase the variety and severity of man-made or environmental hazards in the future (Paterson, 1985).

Burton et al., (1978:223) echo these predictions:

With large numbers of nations in transition, the environment for the short term will continue to become more hazardous. The forces propelling the world toward more and greater disasters will continue to outweigh by a wide margin the forces promoting a wise choice of adjustments to hazard.

2.3.2 THE SOUTH AFRICAN SCENARIO

Table 2.4 provides a list of some of the disasters occurring in South Africa in the 1980s. What is clearly evident are the enormous financial costs incurred, in terms of damage, control and relief costs, apart from human suffering and loss of life. Furthermore, the figures provide an incomplete picture of losses from hazard impacts on all scales, although this would be difficult to quantify.

TABLE 2.4
NATURAL DISASTERS IN SOUTH AFRICA IN THE 1980'S
(HUNTLEY, ET AL., 1989:37)

1981	Laingsburg flood, 114 lives lost
1981	Drought relief, R180 m
1982	Hail damage to crops, R68 m
1983	Drop in maize production from 14 m to 4 m tonnes
1984	Domoina floods, 109 lives lost, R210 m damage
1986	Windstorm damage, E Tvl, R65 m
1986	Hail damage to crops, R98 m
1986	Sandstorms, E Cape
1986	Locust swarms, R40 m control costs
1987	Natal floods, 487 lives lost, R1 100 m damage
1988	Floods, Cape/OFS, R600 m damage
1988	Veld fires, Western Cape, 150 000 ha burnt
1988	Drought relief, R396 m

The 1990s have seen a continuation of this trend started in the 1980s, with the crippling drought continuing unabated in many parts of the country, while the worst storms for many years ravaged the Cape Peninsula in April of 1993, causing 12 deaths ("Twelve killed", 1993). The extreme variations in the weather patterns have been ascribed in part to global warming and the El Nino Southern Oscillation (ENSO) and La Nina events (Hartley, 1993).

Lindesay (1992) suggests that the ENSO and La Nina phenomena have had some effect on increasing the rainfall variability in South Africa, which would account for the increased frequency of drier dry periods and wetter wet periods. Such climatic explanations for the increased frequency of drought and flood conditions are accepted by most as plausible, but it has been argued that the impact of drought and flood occurrences has been exacerbated by careless environmental planning and management.

Huntley, et al., (1989:37) are of the opinion that much of the damage resulting from disasters would have been averted by a "healthy, resilient complex of soils, vegetation and animal life." To compound the problem, many of the poor and disadvantaged people in South Africa are extremely vulnerable to the impact of hazards as a result of living in hazard-susceptible localities, for example, nearly 10 000 South Africans live below the 50-year floodline in floodplain areas (Naidoo, 1993). This alarming situation is particularly acute in the large urban areas, where there is a serious lack of suitably habitable areas, especially for the very poor. These facts serve to highlight how man has made both himself and the environment greatly more susceptible to increasingly severe impacts from hazards in South Africa.

Statistics on global disasters for the years 1947-1973 (Fig. 2.7) suggest that South Africa is relatively free of disasters compared with countries such as Bangladesh and Nicaragua. In comparison with such disaster-prone countries, South Africa appears insignificant. It is asserted, however, that these dated figures provide an incomplete picture of the current situation in South Africa today

for two reasons. Firstly, the threat from environmental or man-induced hazards is greater today than it has ever been and the lives of many are at risk from hazards such as floods, droughts, pollution, desertification etc. Secondly, urban populations have increased rapidly over the past 20 years and marginalised populations find themselves at an increased risk, living in hazardous urban localities. It is asserted, therefore, that South Africa is no longer a relatively disaster-free country: the disasters of Laingsburg in 1981 and Cyclone Domoina in 1984 bear witness to this. Furthermore, it is significant that South Africa is at risk to more than 50% of the 50 hazards listed in Fig. 2.4. While it must be conceded that all the hazards to which the country is susceptible may not be potentially disastrous, they nevertheless may incur compound losses of a substantial nature.

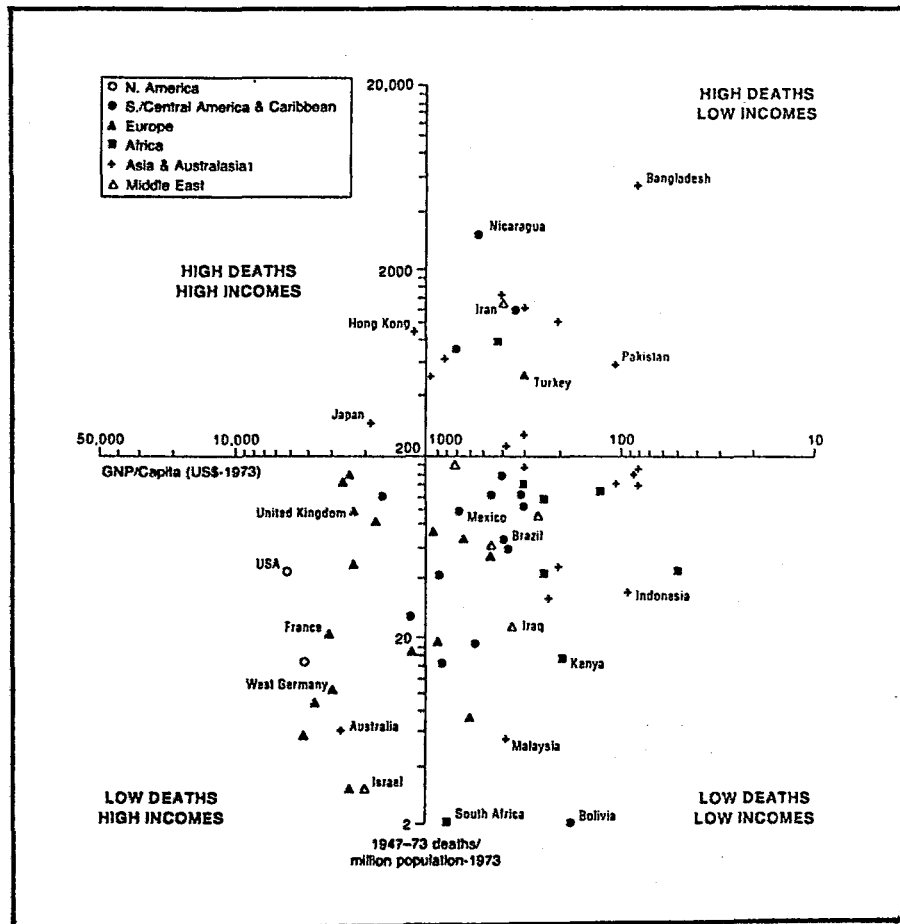


FIGURE 2.7
 DEATHS IN DISASTERS PER MILLION POPULATION, 1947-73,
 BY NATIONAL INCOME (1973 US\$)
 (JONES, 1991:50, ADAPTED FROM DWORKIN, 1974)

2.4 THE IMPORTANCE AND VALUE OF STUDYING HAZARDS

Hazards are recognised as an integral part of the man-environment relationship (Oliver, 1975; Burton *et al.*, 1978; Parker & Harding, 1979; Paterson, 1985; Mitchell, 1989). Fig. 2.1 demonstrates how the interplay between people and environment creates both resources and hazards. The study of hazards is important for a number of reasons, which fall within the broad people-environment theme. Hazard studies:

- (i) provide valuable insights into how man uses and modifies the environment.
 - (ii) provide an examination of how man adjusts to hazardous situations, by means of prevention and mitigation measures.
 - (iii) permit an examination of man's perception of environmental risk and his subsequent adjustments.
 - (iv) form the basis for studies in resource management.
 - (v) enhance awareness of environmental problems and provide opportunities for Environmental Education.
 - (vi) are one of the most effective means of illustrating world inequalities in wealth and suffering.
 - (vii) offer a meaningful bridge between Geographical understanding and real-life circumstances and problems.
 - (viii) offer opportunities for interdisciplinary ventures and challenge Geography's tendency to fragment.
 - (ix) can provide useful utilitarian research findings.
- (Oliver, 1975; Parker & Harding, 1979; Shorthouse, 1984; Paterson, 1985; Wrathall, 1989; Richards, 1990).

It is asserted, therefore, in the light of the above, that the teaching and learning of hazards at secondary school level can have valuable educational benefits, in terms of general education and for Geography specifically.

Hazard studies form an insignificant part of the 1985 Syllabus, receiving only superficial attention as part of a section on

environmental problems in South Africa in the std. 10 course. However, the 1992 Syllabus, as adopted by the Cape Education Department, includes a comprehensive section on natural hazards, precautionary measures and compensation, for study in std. 7 (Appendix 2A). This move to include more environmental topics must be seen as an attempt to keep in line with modern trends in the teaching of Geography. A more comprehensive examination of the 1992 Syllabus, with regard to current thinking in Geographical Education will be offered later in this chapter.

There are many strategies which can be employed in teaching hazards. The researcher believes, though, that one of the most effective ways of teaching hazards is by using case studies. It is therefore the intention of the researcher to show the suitability of this method for the teaching of hazards, and this follows in the next section.

2.5 THE USE OF CASE STUDIES IN GEOGRAPHICAL EDUCATION

2.5.1 DEFINITIONS

A case study may be defined as: "any singular case or example or incident, the description and analysis of which is thought to contribute to our understanding of an area of inquiry" (Bromley, 1986:2).

It is important to differentiate at the outset, though, between two main types of case study based on the purpose of the study:

- (i) A case study used as a strategy in action research (Cohen & Manion, 1989).
- (ii) A case study used as a teaching tool.

This study focuses on the second type. A case study which is developed and used as a teaching tool need not be as rigorous, complete or precisely accurate as a research case study, and its purpose is to engender discussion and debate among students (Yin,

1981; Anderson, 1990). In addition, the criteria for developing good case studies for teaching are different from those for doing research (Yin, 1981).

For the purposes of this study the following will serve as a working definition of a case study in Geographical Education: "A case study is the detailed description, analysis and explanation of some Geographical Phenomenon, which contributes to a fuller understanding of that phenomenon."

Case studies should be detailed and should promote active participation by pupils who are involved in description, analysis and explanation of the phenomenon (Boardman & McPartland, 1993a). It is asserted that short, superficial "case studies" sometimes encountered in educational texts and materials are erroneously termed and should preferably be termed "examples".

2.5.2 THE DEVELOPMENT OF CASE STUDIES IN GEOGRAPHICAL EDUCATION

Roberson & Long (1956) and Thompson (1980) suggest that Herbertson was the first to propose the use of sample studies in proposing the study of specific "sample societies". One could, however, argue that this distinction rests with the famous German Geographer, Carl Ritter, who, as early as 1800 advocated the use of idiographic studies in school Geography, specifically the study of local examples in one's home area (Linke, date unknown). Huxley, too, in 1877 selected the Thames River in London as a "concrete case" in order to illustrate his method (Marsden, 1976).

These embryonic ideas were given further impetus by Fairgrieve in the 1930's and by Scarfe and Mackinder in the 1940's, who promoted the idea of abandoning broad regional studies and of substituting them with real detailed samples or focal points (Roberson & Long, 1956). The real emergence of the use of sample studies as a teaching method occurred in 1950, when Hickman expounded her version of the method. Since then, a number of authors have contributed to the development of the sample (case) study teaching

methods, notably Roberson & Long (1956) (Appendix 2B) and Honeybone (1962). Table 2.5 summarises this development over a period of 30 years. What is immediately apparent from the table is the preoccupation of the authors with primary (mainly agricultural) activities. This is not surprising, though, considering the emphasis on regional studies at the time. Furthermore, the main aims of the lessons were primarily concerned with human response to, and adaptation of, the physical environment. This is a further demonstration the positivistic views of the period and the on-going debate between environmental determinism and environmental possibilism. Pupil applications based on the case studies stressed factual recall type responses. In addition, great importance was placed on the reaching of generalisations. Teaching strategies evident in the materials were predominantly teacher-centred, and group activities were given little emphasis. Pupils were expected to work independently in responding to the questions (see Appendix 2B).

AUTHOR	DATE	EXAMPLE	MAIN AIM OF LESSON
Hickman	1950	Lapp communities of the Scandinavian sub-arctic.	To show how man has become the main factor determining environmental change.
Roberson and Long	1956	Agriculture in a Japanese Buraku (village).	To show human response to the environment in Japan.
Honeybone	1962	Cotton farm in the Gezira, Sudan.	To give a representative example of farming in the whole Gezira Region.
Thompson	1962	Dairy farm in Auckland, New Zealand.	To show human response to the environment on the river plains in Auckland.
Graves	1971	Copper mining at Chuquibambata, Chile.	To show that copper is mined at Chuquibambata, in spite of the unfavourable environment.
Nightingale	1980	Farming and industry in the South Western Cape, South Africa.	To show examples representative of farming and industry in the South Western Cape, leading to tentative generalizations.

In addition, a number of Geographical texts containing a variety of sample and case studies were published at the time. The term "case" study gradually replaced the earlier "sample" study term, as the term "sample" could be interpreted in a statistical sense, which in

fact is incorrect (Bailey, 1974). Table 2.6 gives six examples of such texts which proved to be a useful antidote to the broad regional studies of the time. The table gives evidence of a wide range of sample (case) studies from countries all over the world. The main organising principle is based on a regional framework, and the progression from predominantly primary, rural case studies in the earlier years to secondary, tertiary and urban studies in the later years reflects the changing interests and concerns of Geographers during the different periods.

AUTHOR	DATE	TITLE	STRUCTURE
Fairgrieve and Young	1939	<u>Real Geography</u> Books 1 - 6	6 Books covering the world's continents, to be taught over a period of 3 years. Diverse sample studies from various countries, concentrating on primary activities.
The Geographical Association	1962	<u>Sample Studies</u>	5 Sample studies on diverse primary geography topics, from various world regions.
Rushby, Bell and Dybeck	1967	<u>Study Geography</u> Stages (Books) 1 - 5	A series of sample studies, from low to high population density. 48 Samples from primary and secondary activities mainly.
Hutson	1970	<u>Sample Studies Round The World</u>	22 Sample studies from various countries. All primary and secondary activities.
Beddis and Dyson	1967-1972	<u>Focal Points in Geography</u> Books 1 - 4	Samples of countries occurring within a continental framework. Primary, secondary and tertiary activities.
Peaberton and Swindell	1972	<u>Case Studies in West African Geography</u>	16 Case studies from West African countries, divided into 4 sections : landscape, agricultural settlement, industrial and urban studies.

In comparison, modern texts rarely contain entire collections of case studies based on regional frameworks. Instead, case studies are frequently used to illustrate or to reinforce a Geographical principle or theory and to provide a focus for study. Case studies are presented on a variety of Geographical topics, e.g., environmental issues, urban studies, population studies, recreation and tourism, etc. It is suggested, therefore, that the popularity of using case studies as a teaching method has not changed, especially in Britain, but only the way in which they are organised, presented and are intended to be taught has. British

texts, in particular, exemplify this trend. Such texts, especially those which focus on people-environment relationships, frequently make use of case studies in which pupils describe, analyse and explain data and participate in making decisions and solving real-life problems. Such activities are central to an enquiry-based approach to learning which "involves discussion of the questions, problems and issues, consideration of the relevant aspects of Geographical theory, and the arrival at a solution or a range of possible solutions" (Boardman, 1986:24). The investigation of problem issues is furthermore able to facilitate greater inquiry into human values and attitudes (Bamber & Ranger, 1990). Fig. 2.8 (overleaf) provides a summary of the questions and procedures followed in the enquiry-based approach to learning. Modern British texts are characterised by a wide range of teaching strategies and pupil activities. Table 2.7 provides a sample of modern British texts, which characterise these trends in the use of case studies. Appendix 2C and 5E illustrate some examples of the kinds of case studies to be found in such texts. These case studies, in addition to the use of problem-solving, issue-based activities, have a strong visual appeal and provide a wide variety of interesting and stimulating response materials in the form of diagrams, photographs, statistical data, narrative passages, factual accounts, etc.

AUTHOR	DATE	TITLE	STRUCTURE AND CONTENTS
Jones and Pike	1986	<u>The Active World: Landforms and Hazards</u>	Case studies form part of the organising principle of "system earth". Geographical/environmental topics.
Law and Smith	1987	<u>Decision making in Geography</u>	Case studies on Geographical issues. Pupils involved in decision making exercises.
Ross	1987	<u>Hazard Geography</u>	Case studies on hazards on all scales: Local - National - Global.
Dejardin	1987	<u>Illustrated Environmental Studies</u>	Environmental topics supported by case studies.
Musgrove	1988	<u>Data Response for GCSE Geography</u>	Case studies on all scales on a variety of geographical/environmental topics. Data response exercises.
Porter	1989	<u>Physical Environment and Human Activities</u>	Case studies on environmental topics. "Units" for study.

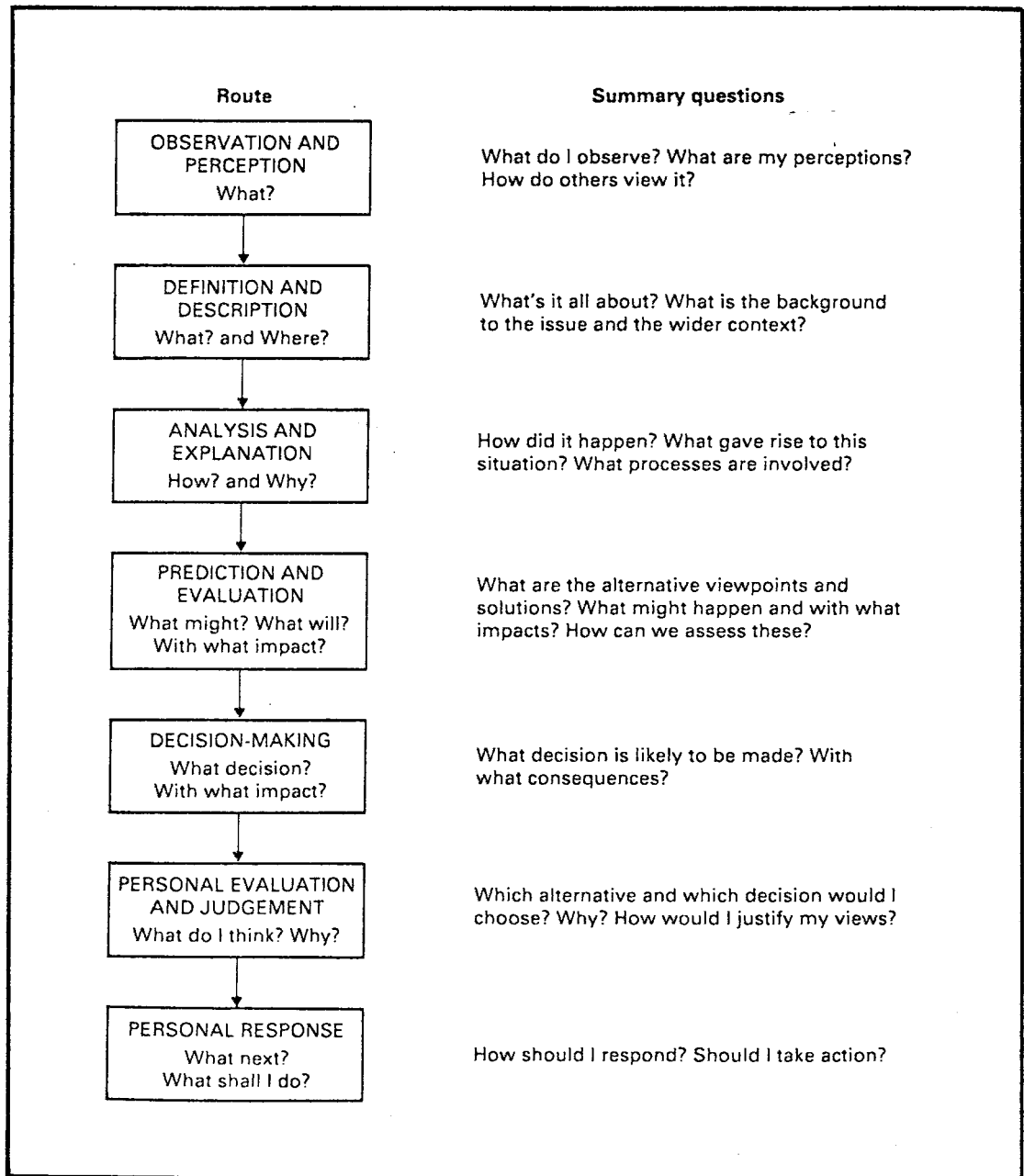


FIGURE 2.8
SUMMARY OF THE ROUTE FOR ENQUIRY-BASED LEARNING
(NAISH, ET AL., 1987:47)

The British journal, Teaching Geography, is a further source of well researched case studies on a wide range of hazards. Topics include: "Earthquake!" (Winskill, 1987); "Forest fires in southern France" (Wrathall, 1987); "Man's acceleration of coastal zone erosion processes" (Williams, 1985) and "Wheal Jane pollution incident role play" (Cass, 1993).

The researcher contends that the majority of case studies to be found in South African texts, e.g. Magi, et al., (1992) and Holmes, et al., (1992) do not provide the same range and type of teaching strategies and pupil activities as the British texts do. The researcher intends to investigate this further in Chapter Five. In addition, there is a dearth of local case study teaching material available (Nightingale, 1980), and this exacerbates the problem for Geography teachers wishing to use case studies as a teaching method.

2.5.3 THE ADVANTAGES OF USING CASE STUDIES

Case studies which are adequately researched, detailed and well presented offer a number of advantages as a teaching strategy, especially for the teaching of hazards. These are:

- (i) Lesson content becomes real, vivid and helps to "bring the subject to life".
- (ii) Case studies give reality and interest to Geography by the inclusion of authentic details.
- (iii) Case studies keep Geographic generalisations firmly anchored in reality.
- (iv) Fieldwork methods are imported into the classroom. A case study may also be conducted outside the classroom, in the field.
- (v) Case studies provide many opportunities for a wide range of active participatory classroom activities.
- (vi) Case studies are adaptable to almost any age and ability.
- (vii) Case studies can be used as a starting point for testing simple models.

- (viii) Case studies can give a presentation of urgent local and global problems and can illustrate the need for conservation.
 - (ix) Case studies can lead to a sympathetic understanding of and more tolerant attitudes towards other people and their needs and problems.
- (Hickman, 1950; Roberson & Long, 1956; Stimson, 1968; Marsden, 1976; Nightingale, 1980; Kelly, 1984; Martinez & Paterson, 1988).

In addition to the above, case studies of Geographical phenomena may be used in examinations, for example, the first paper of the Geography 16-19 A-level course examination in 1982 consisted entirely of an environmental problem. Pupils were expected to make decisions based on the case study (Boardman & McPartland, 1993b).

No teaching method however can be without its disadvantages. Although there are few in this instance, a few "caveats" should be noted:

- (i) Syllabi should not become a mere succession of case studies as there is a danger that the method will be overused and will lose its efficacy.
- (ii) There is a danger that if improperly used the case study method will lapse into a world coverage approach full of trivial facts but of little significance. Clear objectives must therefore be set.
- (iii) Unless the case study is sufficiently detailed it will be elementary and superficial.
- (iv) Case studies are unique. Although there may be elements in common with other studies, generalisations are not always possible and, in fact, are often inappropriate and undesirable.
- (v) Suitable material is not always readily available.
- (vi) Case studies date quickly and the information becomes obsolete in a short space of time. However, older case studies can be used as valuable comparisons with more recent studies of the same phenomenon.

(Hickman, 1950; Roberson & Long, 1956; Honeybone, 1962; Marsden, 1976; Nightingale, 1980; Clark, 1985; Boardman & McPartland, 1993a).

2.5.4 THE USE OF CASE STUDIES IN THE TEACHING OF HAZARDS

The researcher is of the opinion that hazards lend themselves to the case study teaching method for the following reasons:

- (i) Examples of hazard impacts occur frequently on all scales from local to national and to global and the information is immediate, relevant and interesting. Local case studies may be linked to global issues. (Ranger, 1993).
- (ii) Reports on hazard impacts are to be found in a variety of media sources: newspapers, magazines, journals, books, radio and television. Thus, material emphasising various viewpoints can be collated from various sources.
- (iii) Divergent viewpoints on hazard impacts provide opportunities for a wide variety of strategies, such as discussions, various group activities, problem solving, decision making, planning and evaluation exercises.
- (iv) The people-environment theme can be developed fully and hence encourage environmental awareness and conservation.
- (v) A wide variety of material can be used in the development of case studies: factual reports, eye-witness accounts, photographs, diagrams, statistics, etc., and these can be adapted for a wide range of participatory teaching strategies.
- (vi) Such participatory teaching strategies allow for the development of pupils' Geographical skills (oracy and literacy, numeracy, graphicacy and fieldwork), complex critical thinking skills and social skills.
- (vii) Case studies of hazards provide opportunities for overlap with other subjects and for inter-disciplinary studies.

2.5.5 CASE STUDIES IN RELATION TO THE 1992 SYLLABUS

The 1992 Syllabus does not directly mention the use of case studies per se, but the researcher believes that many of the Syllabus principles and aims (Appendix 2A) can be achieved through the use of case studies and, in particular, case studies of hazards. These most significant aims are:

- (i) A global or holistic approach (p.1).
- (ii) Man-land relationship, especially the significance of issues for man (p.1).
- (iii) Pupils should acquire the skills to study the spacial aspects of social and economic problems...problems could be solved and decisions made by way of critical, divergent and creative thinking (p.4).
- (iv) Pupils need to develop a social awareness. This means that they will be expected to
 - * recognise the interdependence of man
 - * acquire a tolerant attitude towards others with different social, economic and political circumstances (p.4).
- (v) Pupils should have environmental awareness and a commitment to the environment by developing a "caring attitude". This means that they will be expected to:
 - * realise that conservation is essential
 - * understand that the balance of nature is largely dependent on man's wise management of his environment (p.4).
- (vi) Pupils need to develop worthwhile attitudes towards learning, for example: respect for evidence; a critical appraisal of reporting; a suspicion of simplistic explanations and a willingness to exchange opinions (p.4).
- (vii) The descriptive versus the problem-solving approach
 - * ... more emphasis should be given to a problem-solving approach.
 - * Pupils should gain insight into the process of decision making by participation in, for example, simulation games and role play (p.5).

From the above it is apparent that the use of case studies has the potential to fulfil a number of the Syllabus aims. The researcher believes, though, that in particular the complex critical thinking skills and affective skills put forward in the Syllabus are not being adequately met by the available case studies in South African texts today for a number of reasons. This will be discussed further in the subsequent evaluation in Chapter Five.

It is asserted that the aims of the 1992 Syllabus have to a large degree been formulated in line with recent developments in Geographical Education overseas and with modern learning theory. This will be the subject of discussion in the next section.

2.6 CURRENT THINKING IN GEOGRAPHICAL EDUCATION

The aim of this section is to outline, briefly, the existing theoretical framework upon which current thinking in Geographical Education is based. An extensive review of past developments is beyond the scope of the thesis.

2.6.1 THE ENVIRONMENTAL PARADIGM

Hall (1984) describes the main paradigm shifts in Geographical Education by suggesting five historical approaches to Geographical knowledge and Geographical Education. These are:

- (i) The Empirical approach, with the emphasis on factual detail.
- (ii) The Rationalist approach, with the stress on intellectualism.
- (iii) The Positivist approach, a combination of Empiricism and Rationalism, emphasising analytic reasoning, respect for evidence and a search for general principles.
- (iv) The Humanistic approach, with the emphasis on values, feelings and emotions, i.e. personal responses.
- (v) The Ecological or Environmental approach, at the

intersection of Empiricism, Humanism and Rationalism, stressing an interactive, holistic approach to knowledge (Fig. 2.9).

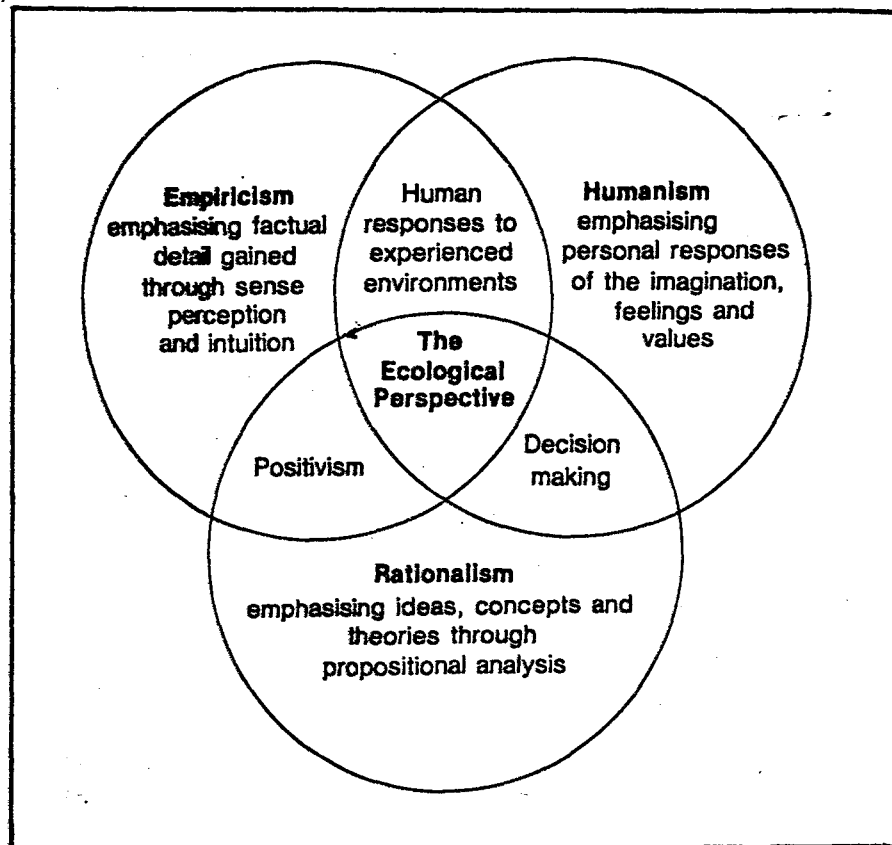


FIGURE 2.9
THE ECOLOGICAL APPROACH TO KNOWLEDGE AT THE INTERSECTION OF
EMPIRICISM, RATIONALISM AND HUMANISM
(HALL, 1984:9)

The Ecological or Environmental paradigm developed in response to the perceived need for a unifying paradigm to close the gap that had opened between the natural and social science components of the discipline and the potential disintegration of the discipline (Preston-Whyte, 1982). In addition, the plea for a more environmentally based Geography and for a greater concern with Environmental issues and problems has come from a number of quarters (Hurry, 1979 and 1987; Kelly, 1984; Ballantyne & Attwell, 1985; Gough, 1989; Pemberton, 1989; Gamble, 1992 and Vogel, 1992).

Van Harmelen (1991:39) summarises the essence of the Environmental Approach to the teaching of Geography:

The application of the Environmental Approach to Geography teaching combines an understanding of process, pattern and relationships in the study of an aspect of the environment with that of perceptions relating to the issues and problems which exist in that environment. The pupil is therefore exposed to cognitive and affective processes, within a framework of knowledge which is perceived as having meaning and which is relevant to the pupils' needs.

The importance of following an Environmental approach to Geography teaching is not so much the inclusion of studying "environmental" topics per se, but the approach used by the teacher. Therefore any topic in Geography can be taught using an Environmental approach, so long as the study emphasises both cognitive and affective processes, and is meaningful and relevant to the pupils.

2.6.2 CURRENT THINKING IN GEOGRAPHICAL EDUCATION WITH REGARD TO BRITISH AND SOUTH AFRICAN GEOGRAPHY SYLLABI

Van Harmelen (1991) concludes that the coherence and structure of British school Geography is essentially provided by the Environmental perspective, following an analysis of Geographical aims in British Schools. The new British National Curriculum for Geography (1991) and the Schools Council Geography Curriculum Project 16-19 (1980) are clearly based on an Environmental perspective (Boardman & McPartland, 1993b). Van Harmelen (1991) suggests too that the Environmental Paradigm forms the unifying principle of the 1985 Syllabus and the 1993 Draft Core Syllabus. An analysis of the aims of the 1992 Syllabus (Appendix 2A) and of the 1993 Draft Core Syllabus reveals a very close correspondence between the two. Apart from minor differences in wording, the syllabi aims are to all intents and purposes, identical. One might conclude, therefore, that the Environmental Paradigm forms the unifying principle of the 1992 Syllabus too. The aims of both British and South African school Geography syllabi stress:

- (i) The learner-centred perspective.
- (ii) That Geography as a school subject ought to foster the pupils' awareness and understanding of their community and the environment as well as the social, political, demographic and economic issues which affect the lives of the individual.
- (iii) That the subject should develop the pupils' awareness of global issues.
- (iv) That Geography in schools should maintain a balance between the pupils' understanding and knowledge of the systems and processes that are related to physical Geography and those that are concerned with human Geography.
- (v) That Geography as a subject is perceived as part of the curriculum as a whole and as such is concerned with fostering and developing skills, concepts and values that are both unique to Geography and which are associated with morally acceptable educational principles (van Harmelen, 1991).

It is notable that the majority of the above aims are stressed by the International Charter on Geographic Education (1992). Skills which are seen as central to Geography include oracy/literacy, graphicacy, numeracy and fieldwork skills. Graphicacy, in particular, is seen as the most distinctively Geographical form of communication (Balchin, 1972). The development of fieldwork skills, too, is seen as a vital part of Geographical Education. It has been suggested, in fact, that "Geography is fieldwork" (Laws, 1984). Apart from the essential recording measurement, research and problem-solving skills developed through fieldwork activities, fieldwork can provide the "concrete experiences which students need in order to grasp new ideas, and incorporate these ideas into their cognitive structures" (Laws, 1984:134-135).

In addition, the development of both cognitive and affective skills is regarded as central to Geographical Education (Bailey, 1986; Boardman, 1986). The development of cognitive (process) skills, in

particular analytical, critical thinking skills, in order to find solutions to ever increasing global problems is seen as one of the most important utilitarian aims of Geographical Education (Fien, Gerber & Wilson, 1984). Social skills ought to be developed through opportunities provided by group activities, such as group discussions and debates, group project work, role play, etc. (Boardman, 1986). Equally important is the fostering of sound values and responsible attitudes towards people and the environment (Fien, Gerber & Wilson, 1984; Bailey, 1986).

These aims, which are central to Geographical Education, will be used as evaluation criteria in the subsequent evaluation. The criteria chosen will be explained more fully in Chapter Four.

It is important now to investigate which learning theories underpin the 1992 Syllabus and to relate this in turn to the Environmental approach to Geography teaching.

2.7 THEORIES OF LEARNING IN RELATION TO THE TEACHING OF GEOGRAPHY

2.7.1 LEARNING THEORIES

Within the constraints of the half-thesis, a full exposition and criticism of the major theories of learning is impossible. The researcher intends, however, to discuss the Constructivist learning theory and its implications for the teaching of Geography. References will be made to the Behaviouralist learning theory where relevant. The researcher believes that the Constructivist learning theory is best suited to the teaching of Geography from an Environmental perspective, as the Constructivist theory's central tenet rests on the belief that teaching should be learner-centred, participatory and problem-based (Underhill, 1991).

Learning, according to the Constructivist perspective:

... is a problem-solving process in which the learner attempts to overcome obstacles or contradictions that arise as he or she engages in purposeful activity (von Glasersfeld, 1983).

One may summarise this definition in one sentence: Knowledge is constructed in the mind of the learner. This perspective is very different from the Behaviouralist perspective, where learning is based on the belief that:

- (i) Learning results in a change in observable behaviour.
- (ii) Behaviour and therefore learning is modified by conditions in the environment.

Underhill (1991) has listed seven assumptions about Constructivist learning theory:

- (i) Cognitive conflict and curiosity are two ways which encourage learners to learn.
- (ii) Peer interaction is a vital element in producing cognitive conflict.
- (iii) Cognitive conflict stimulates reflective (metacognitive) activity. Such activity involves pupils' awareness and control of their own cognitive resources (Campione, et al., 1989).
- (iv) Reflection is the principal catalyst which prompts cognitive restructuring.
- (v) Numbers 1,2,3 and 4 are cyclical.
- (vi) The learner is actively involved in reconstructing his ideas from personal experience.
- (vii) This process empowers the learner to be in control of his own learning.

These assumptions are reflected in the ideas of Piaget, Bruner, Ausubel and Vygotsky. A brief discussion of their contribution to the realm of Constructivist learning theory follows.

Piaget's ideas on how learning occurs in the child have had profound implications for education. According to Piaget, learning takes place in relation to the relevant stage of cognitive development, but is achieved through interaction with the environment. The stages in the development of concept and cognitive skills are fundamental to what is possible and not possible in the concept formation of children (Elliot, 1984).

Learning involves taking the environment apart, physically or mentally, and reconstructing it (Liebeck, 1984). In this way pupils adapt, assimilate and accommodate new experiences (concepts), and in so doing, learn to understand their environment.

Bruner, in contrast, challenged Piaget's central tenet that learning is completely subordinate to biological development (Liebeck, 1984). Bruner's viewpoint is often quoted as "The basic principles of any subject can be taught to any child in an intellectually honest form" (Ballantyne, 1984). This notion may lead to the conclusion that learning and concept development may be speeded up, if learning situations are adjusted, regardless of biological development. Bruner (cited in Salkind, 1985:216) believed in the importance of external factors in the learning situation and that cognitive growth occurs "as much from the outside in, as from the inside out." Furthermore, according to Bruner, the key to intellectual growth is the use of language, which greatly enhances the effectiveness of teaching and subsequent learning. The use of language is seen as a tool for "expanding the pupil's mind (Salkind, 1985).

On the other hand, Ausubel's Expository learning model is based upon the reception of material that either enlarges existing cognitive bases, or establishes new ones where knowledge was lacking (Jones, 1984). Content to be learned is presented to the learner in final form and the learner's task is to receive, internalise and to be able to recall and apply the material learned. Important in Ausubel's three stage model is the first stage of presentation of an "advance organiser". This is a set of

ideas or concepts given to the learner prior to the presentation of the material to be learned. The advance organiser provides material at a higher level of abstraction, generality and inclusiveness than the subsequent learning tasks (Jones:1984). The value of the advance organiser is that it provides a stable cognition structure upon which new learning can be built and enhanced. This is especially important where a learner has no relevant information to which new learning can be related. Therefore, the use of advance organisers assists in a learner's meaningful assimilation of information and ideas. Ausubel, (cited in Bodner, 1986: 877) describes this process of meaningful learning:

To learn meaningfully, individuals must choose to relate new knowledge to relevant concepts and propositions they already know.

Vygotsky's contributions to the realm of developmental psychology have until only recently been fully appreciated (Stoker, 1993). His "socio-cultural" approach encompasses three general themes which permeate his writings:

- (i) The reliance on genetic (developmental) analysis.
- (ii) The claim that higher mental functions have their origin in social life.
- (iii) The claim that an essential key to understanding social and psychological processes is the tools and signs used to mediate them (Wertsch, 1990; 1991).

Vygotsky's primary interest was in sign systems used in human communication, in particular speech, and what role this system plays in the child's conceptual development. He was concerned with how the forms of discourse found in formal schooling provide the underlying framework with which concept development occurs (Wertsch, 1990). Vygotsky, (cited in Bruner, 1985:23) had very clear views on the role of speech in the learning process: "Children solve practical tasks with the help of their speech, as well as their eyes and hands."

Language then, in a Vygotskian sense, is a way of sorting out one's

thoughts about things (Bruner, 1985). The role of language and specifically dialogue in providing "scaffolded" (assisted, guided) instruction is central to the Vygotskian notion of learning (Cole, 1985; Palinscar, 1986). This idea links with Vygotsky's (cited in Palinscar, 1986:74) "zone of proximal development", which he defined as:

The distance between the actual development level as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance, or in collaboration with more capable peers.

Vygotsky's basic belief is that social transaction (interaction) is the fundamental vehicle of education and not individual effort (Bruner, 1985). These views stand in opposition to Piaget's. Vygotsky (cited in Stoker, 1991) maintained that individual mental functions are internalised from relations among children in groups and that reflection is brought about by a child having to defend his views against challenges brought about by other children.

Furthermore, as the child is exposed to words in many contexts, he gains access to meaning systems of which these words are a part, and which have applicability beyond the classroom (Cole, 1990).

Vygotsky's main contributions to the field of Constructivist learning theory can be summarised thus as follows:

- (i) The importance of the child receiving scaffolded (adult or peer supported) education.
- (ii) The importance of social interaction and dialogue in the learning situation. Groups of children should be involved in practical collaborative exercises in problem-solving.
- (iii) The importance of speech as a vehicle for making sense of the world and for developing higher mental abilities.

The ideas of Piaget, Bruner, Ausubel and Vygotsky therefore have

provided many of the central tenets upon which the Constructivist theory of learning is based. Any learning theory, though, must have practical applications in the classroom, and this is the subject of discussion in the next section.

2.7.2 THE CONSTRUCTIVIST PERSPECTIVE AND THE IMPLICATIONS FOR TEACHING

Prawatt (1992:389) claims that most Constructivists:

Envision the classroom as a centre of intellectual inquiry - where teachers and students engage in in-depth explorations of important ideas.

Implicit in this "vision" is the shift in the role of the teacher. This shift necessitates a changing role of the teacher, from someone who "teaches" to someone who facilitates learning, and from someone who teaches by imposition to teaching by negotiation (Bodner, 1986).

If one accepts that a shift towards a Constructivist method of teaching involves the changing role of the teacher, then the following are important elements of this new role:

- (i) A bi-directional flow between teachers and pupils.
- (ii) The teacher questions students whether they are right or wrong, and insists that they explain their answers (Bodner, 1986). It is vital that teachers explore how students see the problem (Yager, 1991).
- (iii) Classroom management strategies should provide genuine opportunities for children to be regarded as individuals. The negotiation of perceptions, meaning and understanding has to begin at the level of the individual (Cheung & Taylor, 1991).
- (iv) The development of methods of group dialogue that allow the achievement of group consensus.
- (v) The teacher has to play the role of both diagnostician and mediator between public and personal knowledge (Cheung & Taylor, 1991).

No list of Constructivist teaching strategies which are based on the changing role of the "teacher" can be complete, but Table 2.8 provides a comprehensive list of such strategies which would be compatible with the Constructivist perspective on learning. These strategies are essentially participatory, learner-centred strategies in which the pupils engage in meaningful problem-solving activities. Importantly, the strategies progress from those which are less demanding to those which are more demanding, i.e. from "invitation" strategies to "taking action" strategies. This list will be used as a guide for the selection of evaluative criteria related specifically to Geographical Education. A more detailed explanation of the strategies chosen as evaluation criteria will be given in Chapter Four.

TABLE 2.8
CONSTRUCTIVIST STRATEGIES FOR TEACHING
(YAGER, 1991:55)

Invitation:	<ul style="list-style-type: none"> Observe surroundings for points of curiosity Ask questions Consider possible responses to questions Note unexpected phenomena Identify situations where student perceptions vary
Exploration:	<ul style="list-style-type: none"> Engage in focused play Brainstorm possible alternatives Look for information Experiment with materials Observe specific phenomena Design a model Collect and organize data Employ problem-solving strategies Select appropriate resources Discuss solutions with others Design and conduct experiments Evaluate choices Engage in debate Identify risks and consequences Define parameters of an investigation Analyze data
Proposing explanations and solutions:	<ul style="list-style-type: none"> Communicate information and ideas Construct and explain a model Construct a new explanation Review and critique solutions Utilize peer evaluation Assemble multiple answers/solutions Determine appropriate closure Integrate a solution with existing knowledge and experiences
Taking action:	<ul style="list-style-type: none"> Make decisions Apply knowledge and skills Transfer knowledge and skills Share information and ideas Ask new questions Develop products and promote ideas Use models and ideas to elicit discussions and acceptance by others

An analysis of the 1992 Syllabus with regard to the Constructivist perspective on learning and Constructivist teaching strategies follows.

2.7.3 THE CONSTRUCTIVIST PERSPECTIVE IN RELATION TO THE 1992 SYLLABUS

It has previously been asserted that the basic paradigm underpinning the 1992 Syllabus is the Ecological (Environmental) Paradigm. Having made this point the researcher now intends to show the links between the Constructivist learning theory and the basic theory which underlies the 1992 Syllabus.

Having isolated the salient features of Constructivism and the implications for changing teaching strategies, it is now possible to point out similarities with the aims of the 1992 Syllabus. The aims and principles embodied in the 1992 Syllabus which have a Constructivist "leaning" are:

- (i) A global or holistic approach (p.1).
- (ii) Education is concerned with the development of the whole child (p.1).
- (iii) The development of intellectual skills and abilities of pupils to promote on-going education (p.2).
- (iv) The development of moral and emotional (affective) attributes in order to enable them to maintain themselves in a demanding world (p.2).
- (v) Pupils should gain proficiency in the use of skills through repetition and the application of the abilities in new situations. (p.3)
- (vi) Pupils should acquire the skills to study the spacial aspects of social and economic problems...problems could be solved and decisions made by way of critical, divergent and creative thinking (p.4).
- (vii) Pupils need to develop a social awareness (p.4).
- (viii) Pupils need to develop worthwhile attitudes towards learning, for example: respect for evidence; a critical appraisal for reporting; a suspicion of simplistic explanations and a willingness to exchange opinions (p.4).

- (ix) ...more emphasis should be given to a problem-oriented approach (p.5).
- (x) Pupils should gain insight into the process of decision making by participation in, for example, simulation games and role play (p.5).
- (xi) Inter-disciplinary studies should form part of the broad teaching strategy (p.6).
- (xii) Teachers should ensure that pupils should become competent in the use of various measuring instruments and other apparatus (p.6).
- (xiii) Teachers should undertake well planned and meaningful fieldwork (p.6).
- (xiv) Teachers should encourage individual and group research techniques (p.6).

While the above list provides reasonable evidence that the Syllabus has elements of Constructivist learning theory and teaching strategies it would be unsound to claim that the Syllabus is based on Constructivism. There are elements of Behaviouralist learning theory and teaching strategies evident in the Syllabus, especially in the formation of knowledge objectives, and the measurement of such "product" outcomes. The researcher, however, believes that the emphasis on the development of process skills and the use of knowledge as a resource, rather than an end in itself, tends to negate Behaviouralist elements in the Syllabus. One might conclude, therefore, that the Syllabus has elements of Constructivism, but is not the underpinning learning theory.

2.7.4 THE TEACHING OF CASE STUDIES IN RELATION TO THE CONSTRUCTIVIST APPROACH

The point was made earlier that a number of the aims of the 1992 Syllabus can be achieved through the teaching of case studies, particularly case studies of hazards. What is evident at this stage is a degree of overlap between those Syllabus aims and the Syllabus aims which have a Constructivist leaning. The most important points of similarity are, briefly:

- (i) A global or holistic approach.
- (ii) Problem solving and decision making by way of critical, divergent and creative thinking.
- (iii) Worthwhile attitudes towards learning.
- (iv) Insight into the process of decision making by participation in ... simulation games and role play.
- (v) The development of both cognitive and affective skills.

In addition, the advantages of using case studies as a teaching strategy have a number of points in common with the Constructivist perspective on teaching. Briefly, these are:

- (i) The emphasis on teaching real, relevant and meaningful content.
- (ii) The adaptability of case studies to different learning situations.
- (iii) Case studies provide a wide range of active participatory teaching strategies.
- (iv) Generalisations are anchored in reality, and case studies move from the easily comprehensible concepts to more abstract generalisations.

The point must be made, though, that while case studies have the potential to be taught from a Constructivist perspective, the responsibility of doing this rests with the teacher.

2.8 CONSTRUCTIVISM, THE ENVIRONMENTAL PARADIGM, CASE STUDIES AND HAZARDS IN RELATION TO THE 1992 SYLLABUS

The claim was made previously that the Environmental Paradigm underpins the S.A. syllabus. Central to this paradigm is the emphasis on knowing how and not knowing what. It is an holistic perspective which provides an interactive approach to knowledge (Hall, 1984). In the light of the previous discussion, the researcher contends that such an approach is not inconsistent with that of Constructivist learning theory.

It would appear therefore, in the light of the aforementioned, that tentative links can be made with regard to :

- (i) The 1992 Syllabus
- (ii) Constructivist learning theory
- (iii) Constructivist teaching strategies
- (iv) The Environmental Paradigm
- (v) The Environmental approach towards Geography teaching
- (vi) The case study teaching strategy, especially with regard to the teaching of hazards.

Fig. 2.10 (overleaf) attempts to show these links and areas of similarity in graphic form.

Recent developments in Geographical Education, such as those discussed in the foregoing section, should be reflected in the available teaching materials (Nightingale, 1974). With this in mind, the following section discusses recent research findings in the field of textbooks, with particular reference to the South African context.

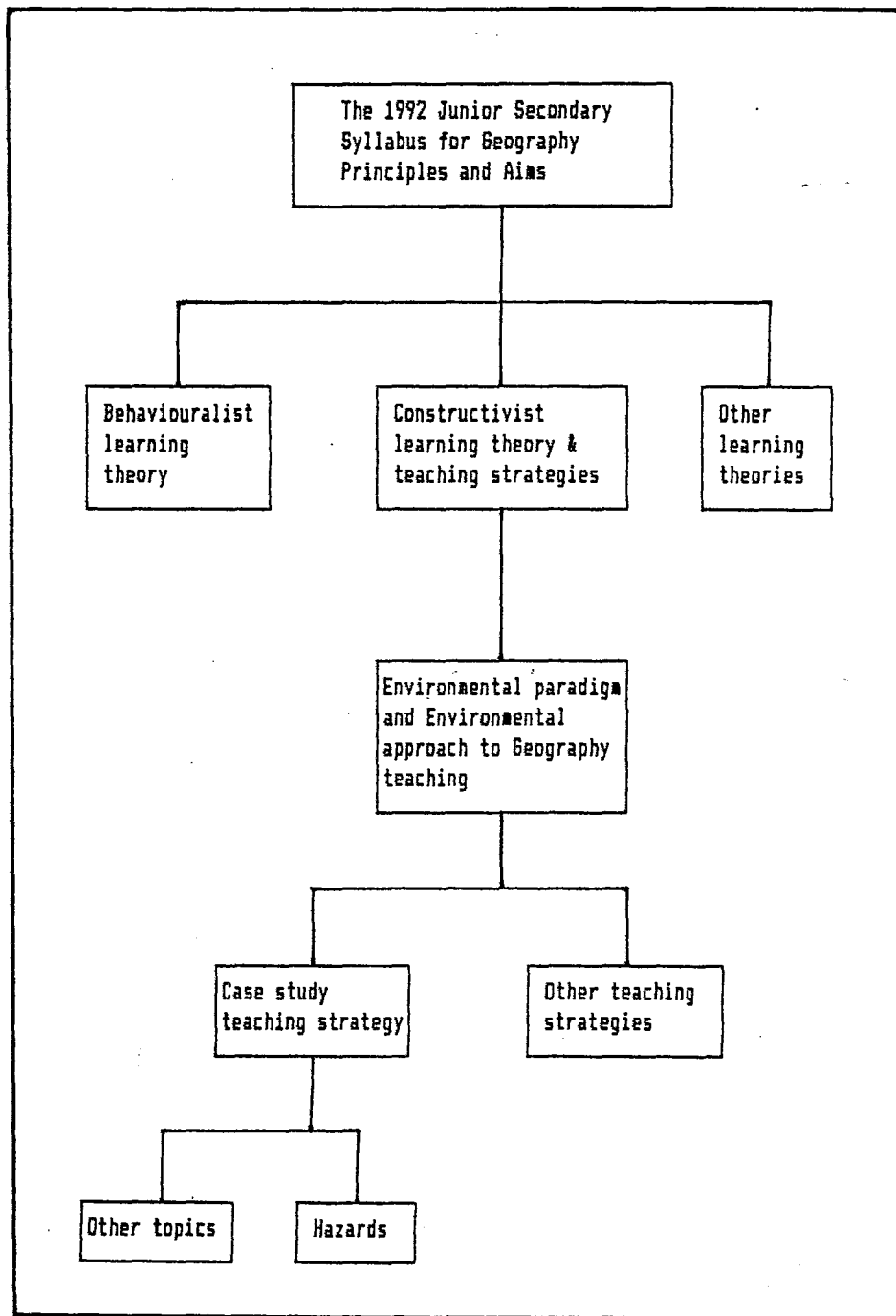


FIGURE 2.10

CONSTRUCTIVISM, THE ENVIRONMENTAL PARADIGM, CASE STUDIES AND HAZARDS IN RELATION TO THE 1992 GEOGRAPHY SYLLABUS

2.9 THE USE OF TEXTBOOKS IN EDUCATION

The assertion was made previously that case studies of hazards as presented in South African Geography textbooks are not adequately meeting the aims of the 1992 Syllabus and therefore also the main ideas of the Environmental Paradigm and the Constructivist learning theory. In order to explore this assertion the researcher undertook an evaluation of South African textbooks in Chapter Five, using criteria based on the current aims of Geographical Education and learning theory, which are evident in the 1992 Syllabus. The teaching strategies employed and the skills which were developed in the applications based on the case studies formed the object of the evaluation. Research in the field of textbooks is regarded as being of substantial importance in South Africa today, for a number of reasons. These reasons will be discussed in the this section.

2.9.1 THE IMPORTANCE OF THE TEXTBOOK IN EDUCATION

Apple & Christian-Smith (1991) claim that there have been thousands of studies of textbooks over the years, and that few aspects of schooling have currently been subject to more intense scrutiny and criticism than the textbook. The importance of the textbook cannot be underestimated, according to Down, (cited in Apple & Christian-Smith, 1991:5):

Textbooks, for better or worse, dominate what students learn. They set the curriculum, and often the facts learned, in most subjects. For many students, textbooks are their first and sometimes only exposure to books and to reading. The public regards textbooks as authoritative, accurate and necessary. And teachers rely on them to organise and structure subject matter.

Altbach (1991) goes even further to describe textbooks as "icons" of education. This is affirmed by Maxwell's (1985) claim that 90% of what occurs in the classroom centres around the textbook. Although these perceptions are based on the American experience, one can find similarities with the current South African situation.

2.9.2 THE ROLE OF THE TEXTBOOK IN THE SOUTH AFRICAN CONTEXT: SOME RESEARCH FINDINGS

Research in the field of the use of textbooks in S.A. reveals some alarming facts. Diepeveen (1982), for example, found that 80% of Geography teachers in the Cape Education Department use the textbook in place of the syllabus. Hatting's (1971) report on an earlier survey in 1966 provides proof of the reliance on textbooks in the South African schooling system. The survey found that 80% of std. 9 and 10 teachers and 69,6% of std 6-8 teachers in South Africa indicated that successful Geography teaching is, to a certain extent, dependent on the use of textbooks. Significantly, the survey did not include the independent and self-governing Black territories in South Africa. One might expect that the percentages would have been far higher had they been included. Mophiring (1983), for example, found that the textbook in Black education is viewed as the most important guide to subject content.

The use of the textbook, therefore, in the South African education system is of fundamental importance. One might expect that textbooks have been the object of comprehensive research in this country, but in fact the converse is true. Wesso & Parnell (1992) claim that a lack of sustained assessments of South African textbooks or curricula is one explanation for the persistence of outmoded curricula. This is particularly true with regard to the lack of research on the effectiveness of texts in promoting learning (Maxwell, 1985). A computer search of the NAVO Database for current and completed research (1993) in the field of textbook research in South Africa revealed only three works, by Drummond & Paterson (1991); Langhan (1990) and Rulashe (research in progress). Further works not revealed by the NAVO search include Clark (1974); Venter (1975); Dean, et al., (1983); Mophiring (1983) and du Preez (1983). Importantly, of these eight works, only four are specifically related to Geography textbooks, and of these four only two are thesis research works. Furthermore, to the researcher's knowledge, no research has been done on the evaluation of applications in textbooks in South Africa, in relation to the

syllabus, and on how such exercises may or may not be promoting effective learning. The researcher suggests two reasons for this: Firstly, the difficulties associated with this type of research, and secondly, the lack of suitably well-developed evaluation theory and methods in this field. With the changing education situation in the country today, and with the huge "backlog" in Black education, textbooks are going to continue to be an extremely important tools in the hands of teachers, and therefore research in this field is vitally important. Research which has been completed though has revealed shortcomings with regard to textbooks in South Africa. Clark (1974); Dean, et al., (1983); du Preez 1983) and Drummond & Paterson (1991) have investigated the problem of author bias in selected textbooks. Langhan (1990) and Rulashe research in progress) have found problems with regard to the readability of texts by E.S.L speakers. In addition, Burton (1986); van Jaarsveld (1988) and Schurmann (1992) have indicated that certain texts in Geography present problems for pupils in conceptualising difficult abstract concepts. These findings suggest that there is much scope for further research in this field in South Africa in the future.

Apple & Christian-Smith (1991:8) make reference to the past educational experience in America, much of which is applicable to South Africa today and for the future:

Faced with large classes, difficult working conditions and even more important - little time to prepare lessons for the vast array of subjects and students they were responsible for, teachers often looked upon texts not necessarily as impositions, but as essential tools.

While accepting that textbooks are a set of compromises between many conflicting forces (Maxwell, 1985) and that textbooks will continue to be flawed in the future, it is asserted that research in the field and the dissemination of findings to the relevant stakeholders can improve textbooks and help to make them more useful tools in the hands of teachers and pupils. One must, however, accept that the ultimate success of a textbook in promoting effective learning rests with the teacher. Well trained teachers in modern methods of teaching will be more successful in

using textbooks as effective tools than poorly trained teachers. However, research has shown that there is a lack of effective teacher training in this country (Ledger, 1977; Ballantyne, 1986). In spite of this, it is suggested that a "good" textbook, which is "teacher-friendly", can aid learning, even where the teacher is not adequately trained. Ideally, what is required is further training in the effective use of textbooks by teachers in South Africa (Ballantyne, 1985; Davies, 1987).

In addition to training in the use of textbooks, teachers need to be trained in methods of textbook evaluation and selection. This is seen as particularly important in the light of the increasing autonomy given to "government" schools over the past years. In the future teachers will have the increasing responsibility of evaluating and selecting textbooks which need to be purchased by schools. Both the Natal Education and the Cape Education Department have discontinued the policy of supplying schools with a list of approved textbooks from which teachers had to choose (Bosman, 1993, pers. comm.; Theron, 1993, pers. comm.). The Transvaal Education Department and the Orange Free State Education Department, however, still maintain the policy of providing schools with a list of approved textbooks (Grover, 1992, pers. comm.; Ellis, 1993, pers. comm.). In practice, however, teachers in the Transvaal Education Department have the freedom to select any texts they need, regardless of the approved list (Grover, 1993, pers. comm.).

When improvements in teacher training and in textbooks are seen as complementary, only then will optimal benefits be reaped for teaching and learning in South Africa.

The researcher believes that, in the light of the arguments set out in favour of research in this field of education, the present inquiry is justified and can yield valuable findings, which can be disseminated to and used by the relevant stakeholders.

2.10 SUMMARY

The use of hazards in Geographical Education formed the focus of this chapter. The literature review showed the increasing toll exacted by hazards in the developing regions of the world. South Africa, as a developing country, will become increasingly more susceptible to a wide range of environmental hazard impacts in the future. In particular the poorer, marginalised people of this country are more at risk. The teaching of hazards affords important opportunities for Environmental Education and has many other important educational advantages. The use of the case study teaching method is shown to be one of the most effective ways of teaching hazards. In addition, the case study teaching method provides the opportunity for fulfilling a number of the 1992 Syllabus aims which are representative of current thinking in Geographical Education and learning theory. Tentative links may therefore be drawn between the 1992 Syllabus, modern learning theory and current thinking in Geographical Education, and the use of case studies of hazards.

Research in the field of textbook evaluation in South Africa is limited. In the light of the importance of the textbook in the South African educational system, this study hopes to fill a notable gap in educational research in South Africa today.

CHAPTER THREE
A REVIEW OF THE THEORY OF EDUCATIONAL EVALUATION

3.1 INTRODUCTION

The type of research undertaken by this study requires a methodology which, while appropriate, is not so narrowly focused that it precludes any wider application. A danger exists in devising an evaluation methodology which is theoretically loose and which is too closely defined by the nature of the study undertaken (Dean, et al., 1983). Sanders (1992) mentions the problems of reliability associated with the use of "home-made" research designs. In an attempt to avoid these problems, the researcher has undertaken a thorough examination and evaluation of approaches towards educational evaluation, and in particular materials evaluation.

Most current evaluation models fall within curriculum evaluation, the curriculum being seen as a programme. The study of hazards falls within the curriculum development process and as such needs to be linked to general evaluation models. The purpose of this chapter, therefore, is:

- (a) to provide the necessary theoretical background to the study, and to place the present study within the broader context of educational evaluation.
- (b) to extrapolate and to develop an appropriate methodology for this study. The final methodology developed therefore represents an eclectic combination of:
 - (i) adaptations of proposed methodologies available in the literature.
 - (ii) other methods specifically developed for this study.

3.2 DEFINITIONS OF EDUCATIONAL EVALUATION

There are numerous definitions of evaluation to be found in the available literature and an examination of such definitions reveals particular attitudes towards evaluation. Tyler's (cited in Potter, 1991b:30) definition reflects a bias towards goal attainment: "Evaluation is the process of determining to what extent objectives are actually being realised." Bloom's (1956) definition also focuses on the aspect of securing evidence on the reaching of objectives.

Wiley (cited in Potter, 1991b:30), however, concentrates on the decision-making aspect of evaluation in his definition: "The collection and use of information concerning changes in pupil behaviour to make decisions about an educational programme."

Gay's (1987:7) definition also emphasises this aspect: "Evaluation is the systematic research ... to make decisions." Cronbach (1963) and Stufflebeam (1983), too, stress the importance of decision-making in their definitions of evaluation.

Scriven (1967), The Joint Committee on Standards for Evaluation (cited in Nevo, 1983) and Nevo (1983) include "to assess the merit or worth" with regard to the evaluation of objects or programmes. This indicates an important development in thinking about educational evaluation, as this shows a departure from the quantitative, positivistic earlier definitions. The phrase "merit or worth" implies a shift towards naturalistic, qualitative evaluation. Parlett & Hamilton (1976), for example, stress the importance of "illuminating" or shedding light on the processes at work in the evaluation. Stake (1976) also emphasises the importance of process evaluations. Nevo (1983:20) provides a clear, concise, yet sufficiently encompassing definition of educational evaluation: "Evaluation is the systematic investigation of various aspects of professional development and training programmes to assess their merit or worth." (My underlining).

3.3 MODELS AND APPROACHES IN EDUCATIONAL EVALUATION

Models of evaluation may be placed on a continuum (Fig.3.1), ranging from those which tend towards the positivist paradigm, to those which are naturalistic in orientation.

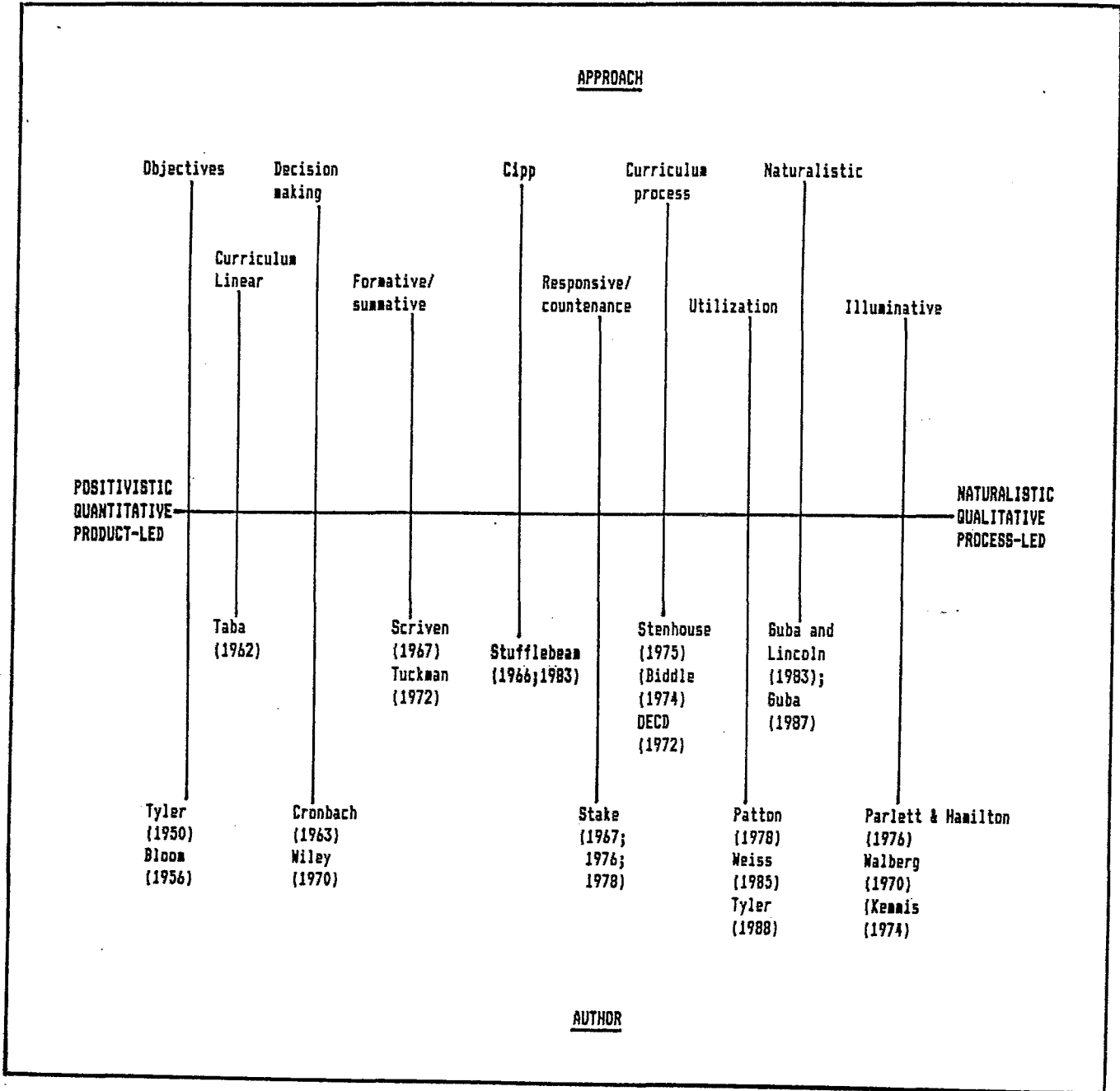


FIGURE 3.1

APPROACHES TOWARDS EDUCATIONAL EVALUATION

To analyse each model (approach) exhaustively would be an unwieldy and unnecessary task for the purposes of this study. Instead, using the continuum as a guideline, a critical overview of the development and trends in evaluation will be given.

The use of such a continuum has attendant weaknesses. Criticisms which may be levelled are over-simplification, arbitrariness and subjectivity. The use, however, of a continuum is in no way meant to replicate reality; nor is it intended to be exhaustive. All it claims to do is to give an indication of the developments and trends in evaluation and therefore examples of types of evaluation models and approaches have been selected for analysis.

The researcher has placed two divergent approaches to evaluation at opposite ends of the continuum. Broadly speaking, these two approaches or paradigms may be termed "traditional" or "classical" and "modern" or "naturalistic". Other terms for the two approaches are the "agricultural-botany" paradigm and the "social-anthropology" paradigm (Parlett & Hamilton, 1976).

The traditional paradigm, which is positivistic in orientation, tends towards quantification. The aim of evaluation is overtly goal or product based (Wolf, 1985 and Taba, 1962). The success of educational outcomes is measured against set behavioural objectives, where learning experiences provide the means of achieving such objectives (Fig. 3.2).

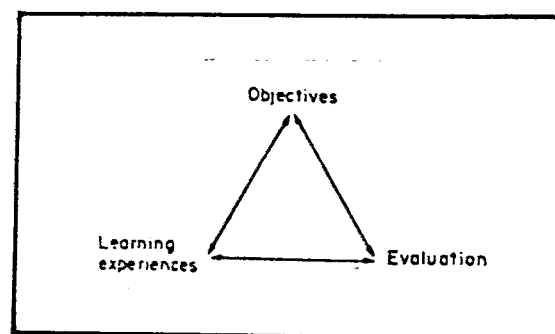


FIGURE 3.2
REPRESENTATION OF THE TYLER RATIONALE
(WOLF, 1985:5324)

Taba (1962) developed Tyler's principles (Fig. 3.2) into practical curriculum planning, with the emphasis on the evaluation of educational outcomes. Taba proposed a model which was essentially linear in the development of curricula (Fig.3.3). Feedback and evaluation mechanisms are confined to the final stage of curriculum planning, and as a result this allows no evaluation and feedback during the earlier stages of planning - hence the terms "product based" or "objectives based" curriculum development and evaluation. Proponents of such an approach, with their own modifications are Bloom (1956), Mager (cited in Marsden, 1976) and Krathwohl (cited in Marsden, 1976).

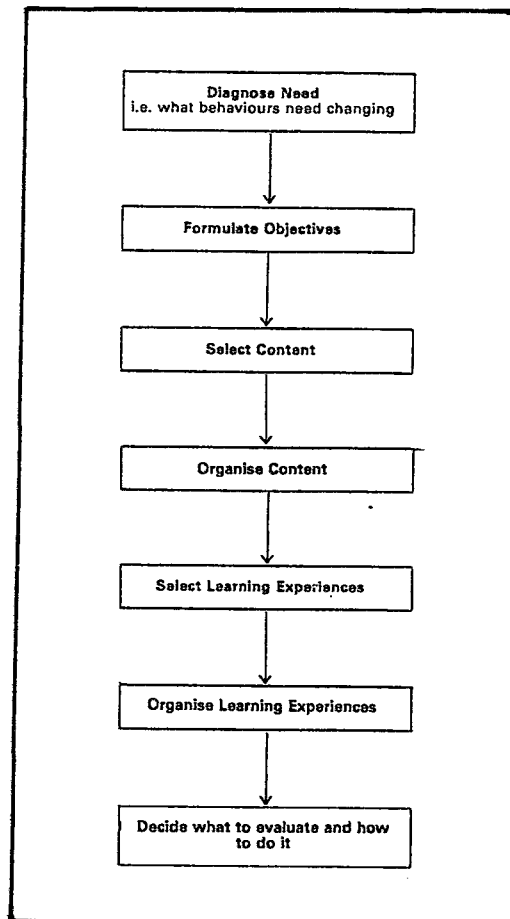


FIGURE 3.3
 TABA'S OBJECTIVES OR LINEAR MODEL OF CURRICULUM PLANNING
 (GRAVES, 1979:25)

Product led evaluation has come under severe criticism. James (cited in Marsden, 1976:24) likened this type of evaluation to a factory, merely an "assembly-line processing of products."

Evaluation of this type is seen to "dehumanise" the curriculum. Parlett & Hamilton (1976) identify the following shortcomings of product-led evaluation models:

- (i) The control of all the relevant variables is difficult.
- (ii) The evaluation is done after the programme has been implemented on a large scale.
- (iii) The study may be limited by the collection of quantitative data.
- (iv) The research design cannot accommodate changes which take place during the evaluation.
- (v) The method may not be sensitive to local or unusual conditions.
- (vi) The method is costly in terms of time and resources.
- (vii) The method cannot always be applied to real-life situations.
- (viii) There is no room for unintended outcomes.

Kliebard (cited in Wolf, 1985) warns against the measuring of trivial objectives, while Scriven (1976) argues that the objectives which are to be measured must first be evaluated to see whether they are worthwhile.

Counter arguments which lend credence to product led evaluations emphasise the appropriateness of this type of evaluation for standardised testing in the armed forces, technical training and in areas of non-formal training in industry (Potter, 1991a). Furthermore the specification of objectives for evaluation is still seen by some as an essential component of curriculum planning. Hirst (cited in Marsden, 1976:27) corroborates this view:

With no clear statement of objectives set out to guide them, teachers only too easily take the statement of the mere content of the curriculum or the syllabus as a statement of the objectives to be pursued (my underlining).

Cronbach (1963), however, claimed that one of the weaknesses of product led models was that they had no capacity for providing information which could assist in the development of innovatory programmes. Cronbach (1963) proposed that the aim of evaluation should be to provide information for decision-making which would lead to programme development. Evaluation should address decisions relating to course improvement, the roles of the individuals in the programme and to administration. In his view an evaluation model should make allowances for:

- (i) Multidimensional outcomes.
- (ii) Programme changes while the programme is in use.
- (iii) The changes brought about by a programme and the identification of aspects of the programme that need revision.

Wiley (cited in Potter, 1991b), too, proposed an approach where the accent was placed on providing information for decision-making, leading to course improvement.

Scriven (1967) coined the terms "formative" and "summative" evaluation. In essence formative evaluation is the assessment of the process of an educational programme, while summative evaluation is an assessment of the outcome of an educational programme (Dane, 1990; Cates, 1985).

The two types of evaluation differ in terms of the questions asked about a programme. Formative evaluation asks the question: How is it operating? while summative evaluation asks the question: What has it accomplished? Scriven (1967:2), however, does not see the two types as mutually distinct from each other:

One role that has often and sensibly been assigned to evaluation is an important part of the process of curriculum development ... such a role does not preclude evaluation of the final product of this process.

Scriven (1967) does suggest, though, that formative evaluations are

better suited to evaluations which aim to improve a product or a programme, while summative evaluations are better suited to evaluations which aim to improve utilization or recognition of the product. Importantly, however, summative evaluation is not relegated to a position of lesser importance to formative evaluation.

Scriven's (1967) major contribution towards the broadening of educational evaluation is that of his recognising the importance of the processes involved in programme or curriculum development, but not to the detriment of the outcomes.

Tuckman (1972) adopted Scriven's terminology in developing a model of summative evaluation, based on five evaluative steps. The model is based on the Tylerian objectives model with the accent on the systematic measurement of behavioural objectives. One modification which can be seen as an improvement is the inclusion of a control group against which to compare the test group.

Educational evaluation is seen to have taken a significant step forward with the development of Stufflebeam's (1983) CIPP model of evaluation which he developed from an earlier model in 1966. The CIPP model is based on the views that "the most important purpose of evaluation is not to prove but to improve" and that evaluation is "a tool by which to help make programmes work better for the people they are intended to serve" (Stufflebeam, 1983:118, my underlining). CIPP is an acronym:

... that includes the first letters of the four kinds of evaluation. The C stands for context evaluation, which is a kind of needs assessment. The I represents input evaluation, which is a means of identifying and assessing competing plans. The P denotes process evaluation, which assesses and guides the implementation of plans. The second P refers to product evaluation, which involves assessing outcomes (Stufflebeam, 1983:140).

Stufflebeam (1983) realised the need for a more holistic approach towards evaluation and furthermore proposed that the context was an important factor influencing educational programmes. Important

advantages of the CIPP model are:

- (i) It provides for entry either before or during a project.
- (ii) It allows for the possibility of conducting a single type of evaluation only, or some combination, depending on the needs of the audience.

Stufflebeam's (1983) model occupies a midway position on the continuum (Fig. 3.1) as it suggests an approach which recognises the equal value of both product and process based evaluation, and allows the evaluator to choose the most appropriate approach according to the context and the purpose of the evaluation.

Although difficult to draw a clear line separating the more traditional approaches from what Stenhouse (1975) terms "new-wave" evaluation, one may discern typical characteristics associated with the more recent models of evaluation, which occupy the right-hand side of the continuum. New wave approaches tend to:

- (i) be more concerned with description and interpretation of programmes or curriculum processes than measurement or prediction of outcomes.
- (ii) be impressionistic and subjective rather than objective.
- (iii) be more humanistic or "social anthropological".
- (iv) stress the importance of multi-method, eclectic approaches to evaluation.
- (v) be more concerned with the atypical or unusual in a situation and hence do not permit valid generalization of results to other situations.

(Parlett & Hamilton, 1976; Potter, 1991a; "Evaluating curriculum: The major concerns" and "Evaluating curriculum models").

Resting firmly within the social anthropological paradigm, and in fact occupying the right pole of the continuum, is Parlett & Hamilton's (1976) model. The authors (1976:99) describe their approach as "illuminative evaluation" where:

Evaluation concentrates on the information-gathering rather than the decision-making component of evaluation. The task is to provide comprehensive understanding of the complex reality (or realities) surrounding the project: In short to "illuminate".

In this approach the evaluator is not called upon to make decisions but to address his or her report to interested parties and stakeholders who may use the information in the report to make decisions. The task of the evaluator is to "concentrate on 'process' within the learning milieu, rather than on the outcomes derived from a specification of the instructional system" (Parlett & Hamilton, 1976:100).

Guba and Lincoln (1983) and Guba (1987) are firm advocates of the naturalistic approach towards evaluation. The authors question the utility of the positivistic paradigm and claim that it "reflects a discredited epistemology of science" (1983:312). However Guba's (1987) five definitions of naturalistic evaluation provide evidence that there is little agreement among authors as to exactly what naturalistic evaluation is.

Guba (1987) proposes what he calls "fourth-generation" evaluation in which he lists the key concepts of negotiation and collaboration among stakeholders and where the product of the evaluation is an agenda for further negotiation. Rather ironically, though, and in a somewhat positivistic vein, Guba (1987:39) offers "ten commandments" for fourth-generation evaluators and it is worthwhile to note the first and most important:

Evaluation is a process whereby evaluators and stakeholding audiences jointly and collaboratively create (or move toward) a consensual valuing construction of some evaluation. It does not yield irrefutable, empirically confirmed information.

This "commandment" reflects much of the thinking of naturalistic evaluators: collaboration, joint valuing and the use of descriptive, illuminative information. This approach stands diametrically opposed to the earlier positivistic evaluations,

where the emphasis is on measurement, testing and the quantification of end product results.

Stake (1967; 1976; 1978), Walberg and Kemmis (both cited in "Evaluating curriculum models") suggest approaches which also fall within the scope of naturalistic evaluation. Stake's three models of evaluation, viz. the Countenance model (1967), the Responsive model (1976) and the Case Study model (1978) can be seen as progressive models, where each is a modification or extension of the previous one. One may isolate certain important characteristics of the three models. They:

- (i) involve description of many different variables.
 - (ii) involve personal value judgements.
 - (iii) include different value standpoints.
 - (iv) use data based on personal experience and participation in the evaluation.
 - (v) emphasise the importance of the learning environment.
 - (vi) consider the information needs of the audience.
 - (vii) report in an informal style.
- ("Evaluating curriculum models").

Walberg's model for research instruction, like Stake's three models, emphasises the importance of the learning environment as a factor affecting the learning process. The author sees learning as a function of aptitude, instruction and the learning environment. Kemmis accentuates the importance of personal experience in his surrogate-experience model, where the task of the evaluator is to "tell it like it is" and to develop a "portrayal" of the curriculum (cited in "Evaluating curriculum models":182).

Another aspect of naturalistic evaluation is that of utilization. Cronbach's (1963) earlier ideas on evaluation for use by decision makers were adopted and modified by Patton (1978) and Weiss (1985), who emphasised utilization-focused evaluations. The aim of this type of evaluation is to provide information to decision makers and stakeholders for programme improvement and for public policy

decisions (Weiss, 1985). Patton (1978) suggests that there are only two requirements in this approach :

- (i) Relevant decision makers and information users must be identified and organised.
- (ii) Evaluators must work actively, reactively and adaptively with these identified decision makers and information users to make all other decisions about the evaluation.

Patton (1978:284) states that "Everything else is a matter for negotiation, adaptation, selection and matching".

Tyler (1988) emphasises that evaluation reports should be aimed at various users in the educational field, in order to facilitate decision making and course improvement. Only information which is pertinent should be given in the report. Tyler is thus making a plea for the wider utilization of evaluation reports.

Naturalistic evaluation is not without its detractors however. Williams (1986) isolates 13 potential conflicts between evaluation standards and criteria for conducting naturalistic enquiry, and concludes that a compromise is usually necessary between evaluation standards and criteria. Furthermore, while conceding that the naturalistic paradigm can be a useful tool, it "should not be embraced thoughtlessly in evaluation projects" (Williams, 1986:12).

Parlett & Hamilton (1976:96) admit, too, that the extensive use of open-ended techniques, focusing and qualitative data "still raises the possibility of gross partiality on the part of the investigator". In addition the problem of the possible limited scope of small scale investigations is mentioned. In both cases, however, the authors offer tentative solutions.

The trend towards process evaluations is reflected in the curriculum development models of Stenhouse (1975) and Biddle (cited in Graves, 1975)(Fig. 3.4).

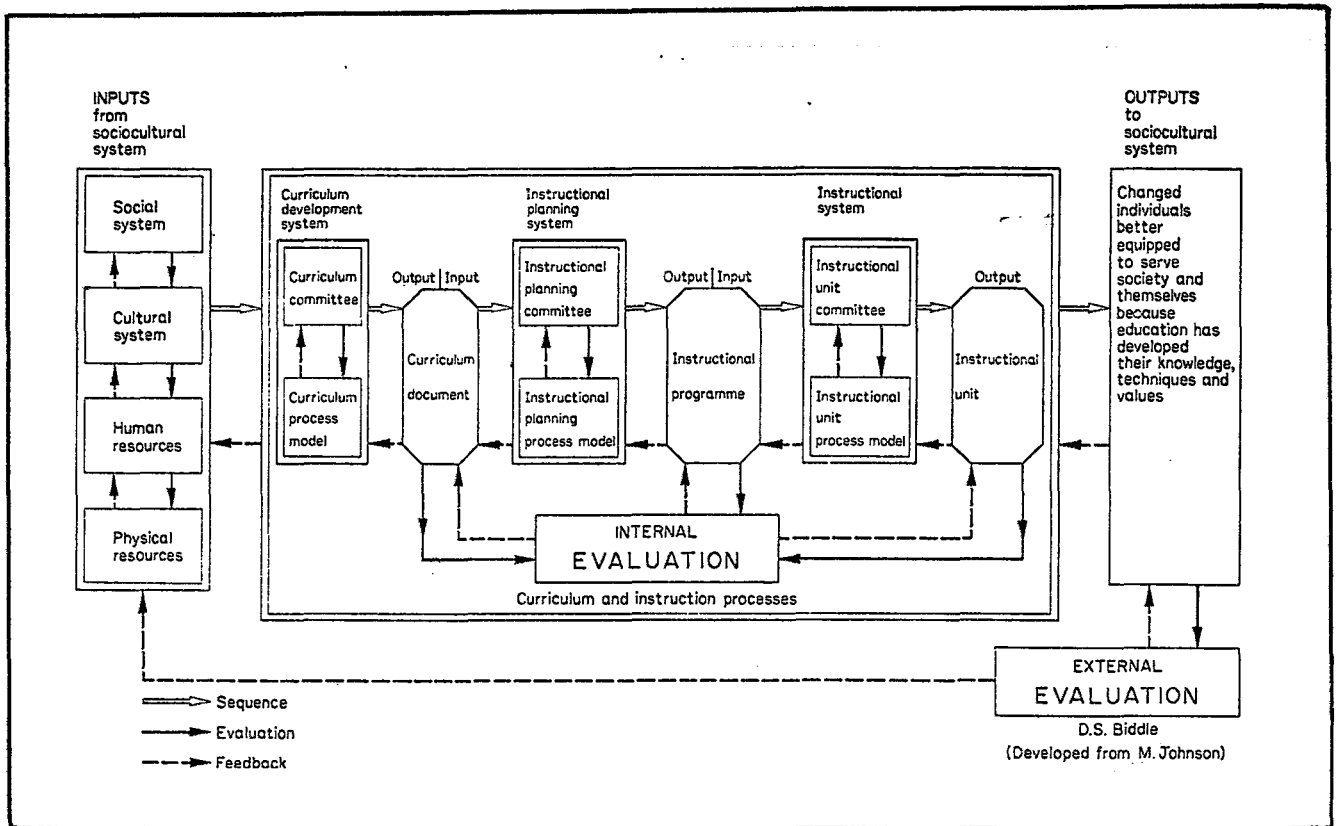
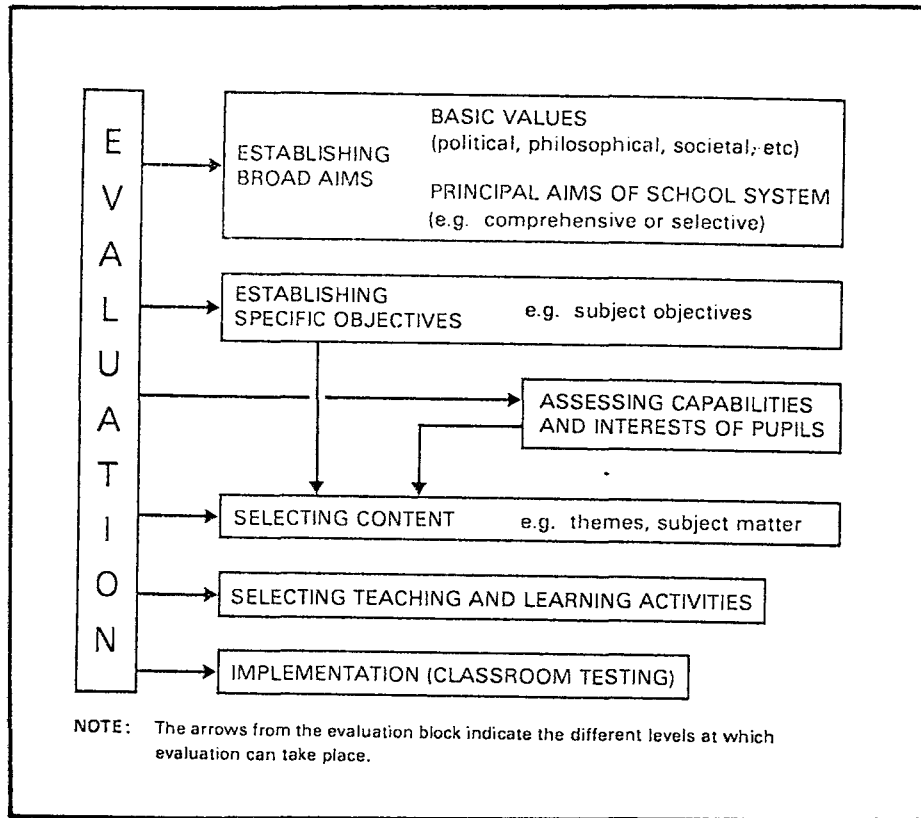


FIGURE 3.4
 BIDDLES'S CURRICULUM DEVELOPMENT AND IMPLEMENTATION SYSTEM MODEL
 (GRAVES, 1975:108)

The model proposed by the OECD's Centre for Educational Research and Innovation (cited in Marsden, 1976) (Fig. 3.5), has the evaluation process running concurrently with every stage of the curriculum development process thereby highlighting the central role of evaluation in the curriculum process. These models are based on the earlier models of Wheeler and Kerr (both cited in Marsden, 1976).

These system models concentrate not on the objectives of the curriculum but on the processes of learning. Precise content learned by the pupil is of secondary importance to the kinds of procedures for acquiring knowledge and skills, hence the name curriculum process models. Furthermore evaluation is envisaged at

each stage of the curriculum process. Decisions made at a particular stage will affect and even prescribe those at subsequent stages, while these decisions in turn feed back to former ones (Marsden, 1976). Curriculum process models must be seen as a reaction to the earlier linear models of Taba (1962) and Tyler (cited in Wolf, 1985).



Curriculum process models place more emphasis on the importance of on-going evaluation. To use Scriven's (1967) terminology, the evaluation of curricula is both formative and summative in that both curriculum processes and outcomes are evaluated. Significantly such evaluations allow for the involvement of more stakeholders and decision makers in the evaluation process: evaluators, educators, educational authorities, funders, etc.

Graves' (1975:89) definition of curriculum evaluation encapsulates the essential characteristics of process models and provides a clear focus for the present study: "Curriculum evaluation is a process of giving information to decision makers about the feasibility, effectiveness and educational value of various curricula."

The present study, with reference to the foregoing discussion, intends to use methods and procedures associated with both positivistic and naturalistic evaluation. The study will attempt to measure the degree of match between the educational materials and the criteria and to "shed light" on the research findings. In addition, the study proposes to describe both the processes and products of the teaching/learning situation with regard to the educational materials.

Having placed the present study within the broader context of educational evaluation, the researcher intends to narrow the focus towards the evaluation of specifically educational materials. The following section deals with this topic.

3.4 APPROACHES TOWARDS THE EVALUATION OF EDUCATIONAL MATERIALS

Educational materials evaluation procedures are varied in the literature. The researcher's aim in this section is not to comment on the results of the research findings as this was provided in Chapter Two, but rather the purpose is:

- (i) to establish some of the characteristics of materials evaluation methodologies from an analysis of previous research and suggested (theoretical) approaches in the literature;
- (ii) to investigate the appropriateness of various evaluation methodologies for the present study.

Davies & Greene (1984:31) assert that: "Teachers' judgements about textbooks vary considerably, reflecting the wide and idiosyncratic range of criteria used in the evaluation" (my underlining).

Dean, et al., (1983:39) mentions a further characteristic of materials evaluation with regard to theoretical frameworks: "Frameworks for analysis have been primarily normative, theoretically loose and frequently defined by the nature of the study undertaken."

Howe (1991) also questions the narrow focus of evaluations and suggests that materials have only been assessed in extremely narrow contexts.

This ad hoc, idiosyncratic approach towards evaluation is criticised, too, by Sheldon (1987), who claims that only sporadic attempts have been made to develop teacher-friendly systems for rigorous assessment.

3.4.1 AN EVALUATION OF EVALUATION METHODOLOGIES USED IN PREVIOUS RESEARCH

The researcher's findings corroborate the above views to some extent. An analysis of current and completed research in the field of materials evaluation reflects some of the characteristics claimed by the above authors. The researcher made every effort to obtain as many current and completed studies in materials evaluation as possible, specifically in this country, but also in overseas countries. Consequently a wide range of 15 evaluation studies was analysed. Tables 3.1 and 3.2 show the studies, which are grouped according to the subject area of the study.

AUTHOR	YEAR	SUBJECT AREA	EVALUATION OBJECT	AIM OF EVALUATION
Drummond and Paterson Langhan Rulashe	1991 1991 Current	Geography	S A Geography textbooks (Senior secondary) Std 3 Geography textbooks (DET) Std 6 Geography textbooks (Ciskei)	Author bias. Readability. Suitability.
Simmons Pomerantz	1989 1991	Environmental Education	E.E curriculum packages (USA) Natural resource educational materials (USA)	Subject areas covered by E.E Packages. Match materials with educational goals.
Coltham Du Preez Dean (et al)	1970 1983 1983	History	History books (British) S A School textbooks S A History textbooks (Tv1) (Secondary)	Educational value. Author bias. Author bias.
Macdonald Newton Strube	1979 1986 1989	Science	Science textbooks (Ciskei) (Form 1 & 2) Science textbooks (British) (O & A level) Science textbooks	Educational value and suitability. Measure "Humanised content". Language style.
Venter	1975	English	S A English textbooks (Cape) (Secondary)	Grammar instruction methods.
Carey	1991	Healthy/ Biology	Cancer Educ. resource (British) (Secondary)	Usefulness / teachers' opinions.
Lockwood	1989	Mixed	Open Univ. preparatory packages (British)	Effectiveness.
Woodward	1987	Mixed	Range of textbooks	Instructional quality.

AUTHOR	EVALUATION		EVALUATION METHODS					SOUND THEORETICAL FRAMEWORK		CRITERIA
	SINGLE PERSON	GROUP	SINGLE	MULTIPLE	MAINLY QUALIT.	MAINLY QUANTIT.	BOTH	YES	NO	NO.
Drummond and Paterson		x	x		x				x	1
Langhan	x			x			x	x		6
Rulashe	x		x				x	x		3
Simmons	x		x				x		x	1
Pomerantz	x			x			x		x	2
Coltham		x	x				x		x	15
Du Preez	x		x		x			x		1
Dean (et al)		x	x				x	x		1
Macdonald		x	x		x				x	4
Newton	x		x			x			x	1
Strube	x		x			x			x	7
Venter	x		x		x				x	1
Carey	x		x				x		x	2
Lockwood	x		x				x		x	1
Woodward	x		x		x				x	3

Table 3.1 reveals a diverse range of subject areas, evaluation objects and aims of the evaluations. Table 3.2 provides a summary of the main aspects of the evaluation methodologies. Four illuminating trends emerge from this figure:

- (i) The high proportion of single-person and single-method evaluation methodologies.
- (ii) The varying number of criteria used in the evaluation.
- (iii) The dearth of sound theoretical frameworks for analysis.
- (iv) The majority of combined quantitative and qualitative methods.

These trends will be analysed in the above order:

- (i) The fact that the majority of the 15 studies used single-person and single-method evaluations is revealing. The lack of any triangulation methods in the majority of the studies may decrease their methodological reliability. It is also notable that no authors mention this as a possible weakness of their research.
- (ii) The wide range of criteria with regard to number supports Davies & Greene's (1984) claim regarding the use of wide and idiosyncratic criteria. Although not included in Table 3.2, the researcher identified a wide range of criteria types too. This is not unexpected, though, as evaluation criteria are determined by the objects and aims of the evaluations, which are diverse in this analysis (Table 3.1). What is exceptional, however, is that in the majority of cases no justification for the choice of criteria has been offered by the authors, and this could put the validity of the studies at risk. Furthermore the use of idiosyncratic criteria might render any comparability among research findings impossible and hence curtail a wider application of these studies.
- (iii) The lack of sound, rigorous theoretical frameworks for analysis supports Dean's, et al., (1983) claim regarding

the use of weak theoretical frameworks. It is important to note however that only three of the studies were in the form of theses, and hence one might expect that the other evaluations, in the form of papers, articles and books, might not use methodologies as rigorous as the theses. One should not, however, have to excuse sloppy frameworks on these grounds alone. The researcher found that most frameworks were in fact loose, vague or non-existent.

- (iv) The majority of studies made use of both quantitative and qualitative methods of analysis. In addition, to use Scriven's (1967) terminology, these studies are both summative and formative. They are summative in the sense that they evaluated "end product" materials of the curriculum development process, but are formative in that they aimed to improve either the educational materials, or in the wider context, the curriculum, or programme.

Of the 15 studies analysed only Pomerantz's (1991) study attempted to evaluate materials with regard to educational goals. This study afforded a useful methodology which provided ideas for the present study. Pomerantz attempted to match the New York State Department of Environmental Conservation's natural resource education goals and principles for elementary students with natural resource education materials. A two-stage screening process identified 700 lessons, which were then matched with the education goals.

Percentage tables provided the number of lessons which covered the instructional goals and principles in three categories: no coverage, some coverage and extensive coverage. Pomerantz (1991) unfortunately does not define exactly what he means by these three categories and this must be seen as a weakness. Besides this shortcoming, the methodology employed was of use to the present study, where a similar "matching process" was undertaken with regard to the aims of the Geography Syllabus and available instructional materials.

3.4.2 AN EVALUATION OF SUGGESTED (THEORETICAL) EVALUATION METHODOLOGIES

In addition to the previous analysis, six theoretical evaluation methodologies were analysed. The researcher made a thorough search for evaluation methodologies which would be relevant and of use to the present study and succeeded in obtaining only six. This points to a lack of suitable methodologies in materials evaluation, and hence this could explain to some degree the problem of idiosyncratic, theoretically weak methodologies. The evaluation methodologies (Table 3.3) which were examined, are those proposed by:

- (i) The National Council of Teachers of Mathematics (1982).
- (ii) Marsh (1992)
- (iii) Steinley (1987)
- (iv) Garcia & Armstrong (1979)
- (v) Hutchinson (1987)
- (vi) Maccoll (1984)

AUTHOR	SUGGESTED EVALUATION OBJECT	METHODOLOGY	CRITERIA	
			NUMBER	TYPE
The National Council of Teachers of Mathematics (1982)	Mathematics textbooks	Mainly quantitative. Checklist. Rating according to weighted criteria.	6 categories	Design elements
Marsh (1992)	Textbooks	Qualitative. Checklist (inventory). Rating on continuum using bi-polar adjectives.	4 categories	Design elements and suitability
Steinley (1987)	Textbooks	Qualitative. Checklist.	11	Design elements to facilitate reading comprehension.
Garcia and Armstrong (1979)	Textbooks	Qualitative and quantitative. Matrix.	6	Author bias.
Hutchinson (1987)	ESL teaching materials	Qualitative. Model with stages.	Determined according to the researcher's needs.	
Maccoll (1984)	Geography teaching resources	Qualitative. Model of criteria and procedures.	numerous	Design elements and suitability.

The aim of the analysis is threefold:

- (i) To point out the strengths and weaknesses of each approach.
- (ii) To ascertain elements of similarity and difference among the approaches.
- (iii) To assess the suitability of the approaches for the present study.

It is important to view each approach in terms of the purpose for which it was devised as this sheds valuable light on the properties and characteristics of its construction (Table 3.3). This is especially true regarding the criteria chosen. All six approaches have some degree of wider application though, and need not be seen as useful for only a limited type of evaluation.

The National Council of Teachers of Mathematics (1982) proposes a checklist composed of six categories of evaluative criteria with regard to various design elements, viz. content, organisation, auxiliary materials, readability, physical characteristics and special considerations. It is proposed that a textbook is rated on a scale from 1 to 5, from a low to a high rating for each of the six categories. The individual category ratings are then added to achieve an overall rating.

The major criticism of this approach is the degree of subjectivity involved in the rating procedure, although the authors do recommend that as many persons as possible be involved in the process. This may improve the reliability of the evaluation but the exact procedures for involving other persons are not made clear. Another criticism is the reducing of a textbook's worth to a numerical value as this may lead to an oversimplification of some of the more subtle, less obvious, but perhaps important features of a textbook.

The authors propose numerous criteria for evaluation within the six broad categories. Although some of the criteria are specifically related to Mathematics, many are capable of wider application to

other subject areas or fields of materials evaluation, and this may be seen as a strength of the approach.

Marsh (1992) proposes a comprehensive four category checklist. The categories are publication and cost, physical properties, content and instructional properties. Within these categories are 39 criteria for evaluation based on suitability and design elements as in the case of those proposed by The National Council of Teachers of Mathematics (1982). Each criterion is rated on a 5 point continuum using bi-polar adjectives, eg. easy...difficult; clear...unclear; exciting... dull. Marsh (1992) claims that the completion of the checklist should provide the reviewer with a very comprehensive picture of the textbook. A major criticism is the subjectivity involved in the rating procedure, which is also a weakness with the previous approach. One must accept however that the evaluation is designed for practising teachers who need a handy tool to evaluate textbooks for specific or general purposes in a comprehensive, yet less rigorous manner. For practical purposes, then, the evaluation methodology is acceptable but for rigorous research it is not.

Steinley (1987), too, proposes a qualitative checklist-type evaluation. The purpose however is limited to the evaluation of aspects of the textbook which aid pupils' reading comprehension. Steinley suggests 11 features of a textbook which may aid pupils' efforts to relate ideas:

- (i) between parts of the text and
- (ii) in the text to the pupils' shared knowledge and experiences.

The author suggests practical features, such as the use of good and frequent examples, illustrations, headings and subheadings.

Steinley (1987) does not suggest any rating or weighting of criteria. The task of the evaluator is only to note the occurrence of textbook features, such as those mentioned above. Although such a method has the advantages of simplicity and ease, it lacks methodological rigour. Steinley does not make any pretences about

rigour however, as he is only suggesting a framework which may be adapted and modified by other evaluators for their specific purposes.

Garcia & Armstrong (1979:32) suggest a "simple procedure for identifying treatment of selected groups". The authors propose a matrix for the analysis of texts in order to determine author bias (Fig. 3.6).

	No reference to status vis a vis other named groups	Indication of status equal to or higher than that of other named groups	Indication of status lower than that of other named groups	
	1	2	3	
ACTIVITY/ PASSIVITY				A
No reference to activity or passivity of target group				
Activity characterizes target group				
Passivity characterizes target group				C

FIGURE 3.6
MATRIX FOR USE IN THE GARCIA-ARMSTRONG MATRIX SYSTEM FOR TEXTBOOK ANALYSIS

Accompanying the matrix is a comprehensive set of guidelines, directions and rules to be followed in the analysis. The authors claim that their method has a number of advantages over existing methods to determine author bias:

- (i) It has the potential for providing information which most other methods do not.
- (ii) Its flexibility allows the targeting of almost any group.
- (iii) It has the potential for establishing high levels of "inter-rater reliability".
- (iv) It has ease of application which allows time saving.
- (v) It focuses on only what has been included in the textbook.
- (vi) The use of a matrix allows for comparative analyses between and among several textbooks.

The authors concede, though, that the method does have one disadvantage as the individual sentence is the unit of analysis, and this may preclude other impressions if the unit of analysis had been longer, such as a paragraph.

Garcia & Armstrong's (1979) method of using a matrix which expresses percentages in each cell was of value to this study, and the matrix suggested by the authors was adapted to suit the specific needs of this study. The advantages mentioned above were also applicable to the use of a modified matrix in this study. The unit of analysis in this study however was individual applications based on the case studies.

Hutchinson (1987) and Maccoll (1984) depart from checklist-type evaluations and propose more sophisticated multiple-stage models of evaluation. Both authors envisage materials evaluation as a matching process, where it is "a matter of judging the fitness of something for a particular purpose" (Hutchinson, 1987:41). It is worthwhile to quote Maccoll's (1984:271) view of materials evaluation as it provides a focused and accurate encapsulation:

Evaluation of resource materials for (Geography) teaching is concerned with appropriateness or match. That is, evaluation procedures attempt to explore the degree of match between the demands and expectations as expressed in syllabus or programme documents or by teachers, and the adequacy of the textbook to satisfy those demands.

Hutchinson (1987) proposes a 4 stage model of evaluation in which the values and assumptions of the teaching/learning situation are matched to the values and assumptions of the available materials (Fig. 3.7)

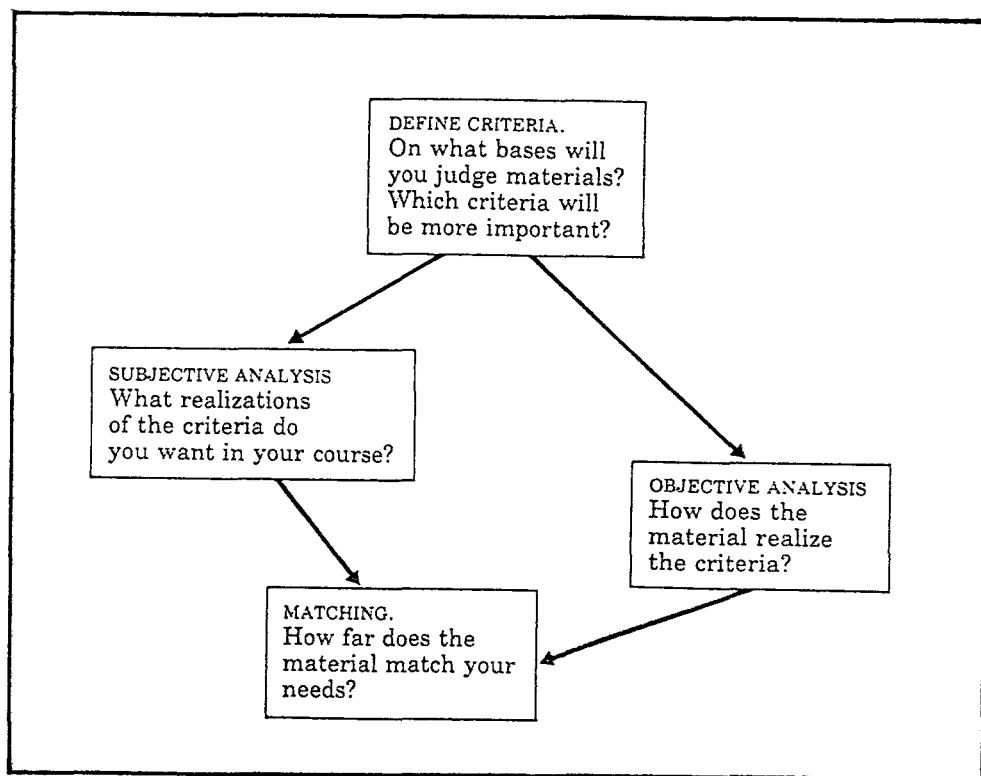


FIGURE 3.7
HUTCHINSON'S 4 STAGE MODEL OF MATERIALS EVALUATION
(HUTCHINSON, 1987:42)

In this model the researcher selects the criteria, based on the needs of the particular teaching/learning situation, and then determines the degree of match between the criteria and the materials. Importantly, Hutchinson (1987:44) suggests that materials evaluation needs to "go beyond the crude categorisation of language level and content" and needs to address the "more

fundamental issues of what views of learning the materials express". This point is very pertinent to this study where the Constructivist view of learning was examined with regard to the case study teaching materials.

Hutchinson's (1987) model is sufficiently flexible to be adapted to the particular needs of the researcher, and this must be seen as a strength. In addition to this, the model is an improvement on the checklist-type evaluations in terms of its potential wider application and the emphasis on identifying the needs of the particular teaching/learning situation. It does not, however, offer the same ease and simplicity of already formulated checklists.

Maccoll (1984) suggests a more complicated and thorough model. (Fig. 3.8). The author (1984:271) is of the opinion that there is a need to develop criteria which provide "a methodological and comprehensive approach to evaluation." Furthermore Maccoll (1984) concurs with Hutchinson (1987) with regard to the importance of specifying the needs and requirements of the individual teaching/learning situation, and hence the need for evaluators to develop their own set of specific criteria.

The proposed model of criteria and procedures provides eight progressive steps in the evaluative process. The author has provided categories of extensive criteria which can be examined in a sequential manner, from step 1 to step 8.

In each stage, the evaluator examines the degree of match between the materials and the demands, needs and expectations of the specific teaching/learning situation. The third stage (Fig. 3.8) is relevant to the aims of the present study. In this stage the philosophy and curriculum guidelines are matched with the content, methodology and methods of assessment to be found in the educational materials.

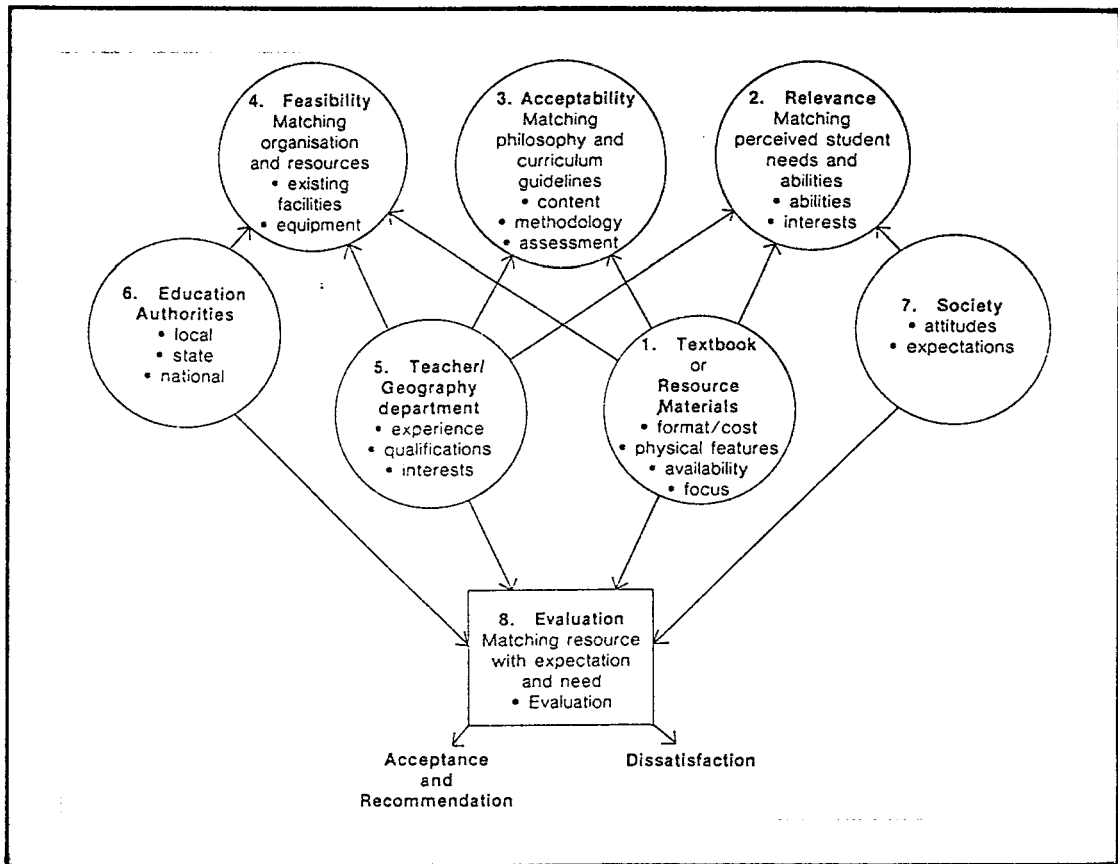


FIGURE 3.8
 MACCOLL'S MODEL OF CRITERIA AND PROCEDURES
 FOR EVALUATING RESOURCES
 (MACCOLL, 1984:272, AFTER HARDING, 1978)

This study is concerned with an evaluation of pupil skills and teaching strategies and this forms a part of Maccoll's assessment of methodology and methods of assessment in stage 3 of his model.

Maccoll's model is valuable as it places the present study within the broader context of the whole materials evaluation process. The researcher has identified a need for intensive research into only one aspect of materials evaluation i.e., matching the curriculum aims with the available teaching materials. There is, however, tremendous scope for further research with regard to the other categories in Maccoll's (1984) model.

3.5 SUMMARY

Many definitions of educational evaluation exist in the literature. Each definition reveals a particular view of the purpose of evaluation. Models of evaluation may be placed on a continuum, ranging from those which are essentially positivistic, quantitative and product-led to those which are naturalistic, qualitative and process-led. The present study is concerned with evaluating both the process of teaching and learning and the product of teaching and learning and thus has elements of both positivistic and naturalistic evaluation.

What was particularly useful in the analysis of evaluation approaches was the fact that the broad evaluation paradigms provided the theoretical underpinning upon which to base the evaluation, while the research and methods related to materials evaluation provided the techniques and procedures for this study.

The examination of materials evaluation methodologies revealed a wide range of evaluation aims, objects, methodologies and evaluative criteria. The most notable weaknesses revealed were the lack of sound theoretical frameworks for analysis and the use of single person, single methods evaluations which might reduce the reliability of the evaluations. Methodologies and ideas of use to the present study are those proposed by Garcia & Armstrong (1979), Maccoll (1984), Hutchinson (1987) and Pomerantz (1991). The evaluation methodology used in this study is a eclectic combination of elements of the above methodologies and other methods specifically developed for the evaluation, which will be discussed in Chapter Four.

CHAPTER FOUR
METHODOLOGY

4.1 INTRODUCTION

Chapter Three provided the theoretical background to the methodology adopted in this study. This chapter sets out the evaluation methodology applied in the study. The methodology put forward in this chapter was developed in order to meet the specific requirements of the study, based on an adaptation of ideas and methods proposed by Garcia & Armstrong (1979), Maccoll (1984), Hutchinson (1987) and Pomerantz (1991).

The methodology was devised to be simple, yet reliable. Both quantitative and qualitative methods were used in the evaluation. This permitted both measurement of the degree of match between the evaluative criteria and the teaching materials, and qualitative description of the results.

This chapter, therefore, describes the evaluation aims, the procedures followed and the problems associated with the methodology.

4.2 EVALUATION METHODOLOGY

4.2.1 AIMS OF THE EVALUATION

- (i) To determine the extent to which case study teaching materials of hazards in South African Geography textbooks represent:
 - (a) the aims of modern Geographical Education, as evidenced in the 1992 Syllabus.
 - (b) the Constructivist view of learning, as evidenced in the 1992 Syllabus.
- (ii) To compare a case study in a British text with the South African case studies, with regard to (a) and (b) above.

4.2.2 RESEARCH PROCEDURES

In order to achieve these aims, the research procedures involved the following:

- (i) A theoretical analysis of existing evaluation frameworks (Chapter Three).
- (ii) A broad evaluation of case study teaching materials on hazards to be found in South African std. 7 Geography textbooks, used by the House of Assembly schools in the Cape Province, Natal, Transvaal and the Orange Free State.
- (iii) A specific, in-depth analysis and evaluation of selected case study teaching materials from the above mentioned texts.
- (iv) A specific, in-depth analysis and evaluation of a case study to be found in British texts and resources.

4.2.3 EVALUATION CRITERIA

In order to measure the achievement of these aims, the following evaluative criteria, as previously discussed in Chapter Two, were chosen:

- (i) Skills related to Geography specifically: oracy/literacy, numeracy, graphicacy and fieldwork.
- (ii) Other cognitive and affective skills and objectives: Process skills, attitudes and values, interactive social skills (Table 4.1).
- (iii) Constructivist teaching/learning strategies (Table 4.2).

TABLE 4.1
EVALUATIVE CRITERIA:
COGNITIVE AND AFFECTIVE SKILLS AND OBJECTIVES

1.	<u>PROCESS SKILLS:</u>
	1.1 Factual recall
	1.2 Comprehension
	1.3 Application
	1.4 Analysis
	1.5 Synthesis
	1.6 Evaluation
2.	<u>ATTITUDES:</u>
	2.1 Towards people
	2.2 Towards the environment
3.	<u>VALUES</u>
4.	<u>INTERACTIVE SOCIAL SKILLS</u>

TABLE 4.2
EVALUATIVE CRITERIA:
CONSTRUCTIVIST TEACHING/LEARNING STRATEGIES

1.	<u>INTRODUCTORY/EXPLORATORY ACTIVITIES</u>
	1.1 Brainstorming exercises
	1.2 Debates and discussions
	1.3 Role play
	1.4 Simulations and games
	1.5 Examining and reviewing evidence
	1.6 Examining and reviewing options
	1.7 Conducting experiments
	1.8 Conducting fieldwork
2.	<u>EXPLANATORY/SOLUTION ACTIVITIES</u>
	2.1 Providing and explaining ideas
	2.2 Reviewing and evaluating ideas
	2.3 Providing and explaining solutions
	2.4 Reviewing and evaluating solutions
	2.5 Predicting outcomes/consequences
	2.6 Reading group consensus
	2.7 Model design and explanation
	2.8 Scientific field research
3.	<u>TAKING ACTION</u>
	3.1 "Framework fieldwork"
	3.2 Writing reports/letters
	3.3 Involvement in real-world/local issues

Some of the criteria (Tables 4.1 and 4.2) however need further discussion and clarification:

Table 4.1

- (i) Process skills were arranged in an hierarchy, from the less complex factual recall skills to the more complex evaluative skills, based on Bloom's (1956) Taxonomy of Educational Objectives. Appendix 4A provides the definitions for the hierarchy of process skills which were used in this study.
- (ii) For the purposes of this study, values are defined as "our values and principles for judging worth" (Shaver & Strong, 1982:17). They are not simply feelings or emotions, but have intellectual meaning that can be defined and clarified (Shaver & Strong, 1982). Attitudes on the other hand are not to be confused with values and are defined as "packages of beliefs which influence us in decisions" (Slater, 1982:90). "Together, our values and beliefs determine our attitudes or positive and negative feelings towards issues, and ultimately these attitudes find expression in behaviour" (Raw, 1989:19).

Table 4.2

- (i) Role play refers to activities which require learners to adopt various roles in order to examine a particular problem or issue (Fien, Herschel & Hodgkinson, 1984). Pupils are required to "accept a new identity, step inside someone else's shoes, and act and react as appropriately as he is able" (Taylor & Walford, 1972:18). The essential core of the activity is understanding the situation of the other person. For the purposes of this study, role playing activities included both physical and mental role playing.
- (ii) Simulation refers to activities in which "pupils manipulate a model or play roles which assist them to develop an understanding of, and a feeling for, the

reality being presented" (Fien, Herschel & Hodgkinson, 1984:114). Simulations are more complex, lengthy and less flexible than role playing activities (Ladousse, 1987). A game on the other hand, is an activity in which pupils "use data and/or skills in a competitive situation against themselves, each other, the teacher as game master, chance or the environment" (Fien, Herschel & Hodgkinson, 1984:114). The situation in a game does not need to reflect reality as accurately as a simulation does (Fien, Herschel & Hodgkinson, 1984).

- (iii) Fieldwork refers to elementary information gathering field exercises. Field demonstrations are included in this activity.
- (iv) Scientific field research refers to activities which require pupils to propose an hypothesis and then verify this by research and experimentation in the field.
- (v) "Framework fieldwork" is a term coined by Hart & Thomas (1986). It refers to an approach to fieldwork studies which "seeks both to emphasise the significance ... of people-environment interactions, and to explain the nature and relevance of Geographical ideas and concepts by references to these interactions (Hart & Thomas, 1986:207). "Framework fieldwork" requires the use of procedures "which are aimed at establishing the nature and extent of people-environment actions" (Hart & Thomas, 1986:209). Data are therefore collected on both factual aspects of the topic under study, but also for the human values dimension (Hart & Thomas, 1986).
- (vi) Providing and explaining ideas and reviewing and evaluating, ideas for the purposes of this study, refers to strategies eliciting original ideas from the pupils. Their ideas should supply evidence of original thought on some topic. Teaching strategies resulting in a mere regurgitation of facts are therefore excluded.
- (vii) Writing reports and letters refers only to authentic activities where reports and letters are written and sent to "real" people, e.g., sending recommendations for the

regulation of factory smoke emissions to the relevant authorities, based on a study undertaken by the class.

- (viii) Involvement in real-world/local issues refers to those activities which require pupils to involve themselves physically in actions related to the resolving of real issues in the local area, e.g., a river clean-up in the neighbourhood.

4.2.4 DATA SOURCES

Data were collected from the following sources:

- (i) Std. 7 Geography textbooks used by House of Assembly schools in the four provinces.
- (ii) British Geography texts and resources.
- (iii) The 1992 Syllabus.

4.2.5 DATA COLLECTION PROCEDURES

The following procedures were followed:

- (i) Written and telephonic enquiries were made to all the publishers of Geography textbooks in South Africa in order to ascertain the exact number of std. 7 textbooks available in 1992. Consequently seven were obtained from their respective publishers (Appendix 4B). Only texts which were based on the 1992 Syllabus were obtained as the section on hazards is not included in the earlier 1985 Syllabus. These seven texts are presently used by the House of Assembly schools in the four provinces and not by schools falling under the control of the Department of Education and Training, House of Representatives and House of Delegates who rejected the 1992 Syllabus, and thus still make use of texts based on the 1985 Syllabus.
- (ii) British Geography texts, teaching journals and other resources were selected from the following sources in Grahamstown: the Rhodes University Main and Education Department libraries, the

Municipal library and the Graeme College library. Those with case studies of hazards were selected for further screening.

4.2.6 DATA SCREENING AND SELECTION PROCEDURES

The data for analysis were subjected to the following screening procedures (adapted from Pomerantz, 1991), in order to reach a final selection of case study materials for the evaluation:

- (i) Materials had to meet the definition of a case study i.e., "a detailed description, analysis and explanation of some Geographical phenomenon, which contributes to a fuller understanding of that phenomenon" (Chapter Two). Furthermore the word "study" implies active involvement by the pupils. Therefore, "case studies" which did not have applications based on the materials were disregarded. In addition, short, descriptive "examples" were ignored.
- (ii) Materials had to meet the definition of a hazard. Paterson's (1985:23) definition (Chapter Two) of both natural and environmental hazards provided a satisfactory definition:

Natural hazards arise through the action of geophysical and biological processes. Environmental hazards involve the interaction of natural processes with man-induced ones, and bring more widespread, long-term changes affecting environmental quality.

In addition, materials on the full range of hazard threats/impacts, on all scales of magnitude and frequency, and not only disasters were subject to the screening process.

Consequently 42 case studies from the std. 7 texts (Appendix 4C) met the above criteria and were subsequently evaluated. Of these 42 case studies, four were selected for further in-depth analysis, based on their ability to meet the evaluation criteria most satisfactorily or unsatisfactorily. One case study was selected from the British sources, viz. "Disappearing soil - a case study of Lesotho" in Musgrove's (1988) text, for the same in-depth analysis, as a means of comparison with the South African examples.

4.2.7 DATA ANALYSIS

Quantitative and qualitative methods were used in order to achieve the aims of the evaluation. Four stages were involved in the analysis, adapted from Garcia & Armstrong (1979):

Stage 1

The 42 case studies were analysed in order to show which skills were being developed by the applications based on the case studies, using the evaluation criteria previously chosen. For this purpose a matrix was developed (Appendix 4D) based on Garcia & Armstrong's (1979) evaluation matrix (Fig. 3.6). The matrix has the advantage of permitting a more comprehensive, comparative analysis of data. The following procedure was used in the analysis:

Each application based on the case study was examined in order to determine which cell(s) best described it in the skills evaluation matrix (Appendix 4D). A tick was then placed in the category (or categories) which best fitted the application. Some applications developed a range of skills, and in these cases ticks were placed in all the appropriate skill categories. In the case of process skills, only the highest skill developed was recorded. A matrix was used for each individual case study, because of the number of applications and a single matrix used for the analysis of all the case studies would have been impractical and unwieldy. The number of skills developed in each category was determined by counting the ticks for that category. Totals were then calculated horizontally and vertically (Appendix 4D). This procedure was repeated for each of the 42 case studies. Then, totals for each category were determined by adding together the respective categories from the 42 case studies. Each category was then assigned a percentage, by dividing the count for each category by the total number of skills determined in the 42 case studies. The final table used for the presentation of results (Chapter Five) therefore represents an analysis of skills based on percentages (Table 4.3).

TABLE 4.3 MATRIX FOR THE PRESENTATION OF THE RESULTS OF THE SKILLS ANALYSIS						
OTHER SKILLS/OBJECTIVES		GEOGRAPHICAL SKILLS				
		oracy/ literacy	graphicacy	numeracy	fieldwork	TOTAL
		X	X	X	X	X
PROCESS	factual recall					
	comprehension					
	application					
	analysis					
	synthesis					
	evaluation					
ATTITUDES	people					
	environment					
VALUES						
INTERACTIVE SOCIAL SKILLS						
TOTAL						

Stage 2

The 42 case studies were analysed in order to determine the number and type of Constructivist teaching strategy used in the 42 case studies. For this purpose a Constructivist teaching strategy evaluation table was developed (Appendix 4E). Each application based on the case study was examined in order to determine the Constructivist teaching strategy (or strategies) employed (Table 4.2). A tick was then placed next to the appropriate strategy (or strategies) in the Constructivist teaching strategies evaluation table (Appendix 4E). As in the skills analysis, an evaluation table was completed for each case study. Totals were then calculated by adding together all the ticks for each strategy. A vertical total was then calculated (Appendix 4E). This procedure was followed in the analysis of each of the 42 case studies. Totals and related percentages for each strategy in all the case studies were then

calculated by following the same procedure in the calculation of totals and percentages in the skills analysis. Therefore, as in the skills analysis, the final table (Table 4.4) used for the presentation of the results of the Constructivist teaching strategies analysis (Chapter 5) represents the relative percentages commanded by each strategy in the 42 case studies.

TABLE 4.4 TABLE FOR THE PRESENTATION OF THE RESULTS OF THE CONSTRUCTIVIST TEACHING STRATEGIES ANALYSIS		
CONSTRUCTIVIST TEACHING STRATEGIES		%
INTRODUCTORY/ EXPLORATORY ACTIVITIES	<ol style="list-style-type: none"> 1. Brainstorming exercises 2. Debates and discussions 3. Role play 4. Simulations and games 5. Examining & reviewing evidence 6. Examining & reviewing options 7. Conducting experiments 8. Conducting fieldwork 	
EXPLANATORY/ SOLUTION ACTIVITIES	<ol style="list-style-type: none"> 1. Providing & explaining ideas 2. Reviewing & evaluating ideas 3. Providing & explaining solutions 4. Reviewing & evaluating solutions 5. Predicting outcomes/consequences 6. Reaching group consensus 7. Model design and explanation 8. Scientific field research 	
TAKING ACTION	<ol style="list-style-type: none"> 1. Framework fieldwork 2. Writing reports and letters 3. Involvement in real-world/local issues 	
TOTAL		

Stage 3

A specific, in-depth analysis of four case studies selected from the 42 case studies was made. Two case studies were selected for further analysis based on the broad and comprehensive range of skills and teaching strategies they exhibited in the broad evaluation (stages 1 and 2). A further two were selected for further analysis, based on the limited range of skills and

strategies they exhibited in stage 1 and 2 of the analysis. The purpose of this evaluation was to provide a means of comparison between what one might term a satisfactory case study and an unsatisfactory case study, based on the evaluative criteria. Such an analysis would also point to the range of case study skills and strategies evident in the 42 case studies. The detailed analysis was mainly qualitative, where each case study was analysed and discussed in terms of the evaluative criteria. The tables used for the presentation of the results of the analysis of the four case studies (Chapter 5) were the same as those used in the presentation of results in stages 1 and 2 of the analysis (Tables 4.3 and 4.4), except for the use of numbers in place of percentages.

Stage 4

The case study selected from the British text was analysed in the same way as each of the 42 case studies was, as described in the above stages. The table used for the presentation of results of this case study was the same as those used for the four South African case studies, as explained in Stage 3 above. The purpose of this analysis was to provide a means of comparison with case studies available in South African texts.

4.2.8 PROBLEMS ASSOCIATED WITH THE EVALUATION METHODOLOGY

The researcher acknowledges that the research methodology has certain problems and limitations:

- (i) The list of skills and Constructivist teaching/learning strategies cannot be complete; this may have affected the results of the analysis to some degree. The criteria were, however, chosen for their appropriateness and relevance to this study and not for their comprehensiveness.
- (ii) Subjectivity is involved in the analysis of data. The researcher used a single-person, single-method evaluation procedure and it is acknowledged that the methods of triangulation might have improved the reliability of the evaluation methodology. It was felt however that the use of such methods would have complicated the research procedure

unnecessarily. It is possible that in some cases, other researchers would have categorised a skill or strategy differently.

4.3 SUMMARY

This study adopted a research framework which would allow for the measurement and description of the degree of match between the evaluative criteria and the teaching materials. Accordingly, a four-stage research procedure was adopted in order to meet the aims of the evaluation. The evaluative criteria were selected and justified, based on the examination of the current aims of Geographical Education, in relation to current learning theory, in Chapter Two. Data collection, screening and selection processes were outlined, in preparation for the data analysis, which involved four stages. Problems which may be encountered with the evaluation methodology include subjectivity and the omission of certain evaluative criteria.

CHAPTER FIVE
ANALYSIS OF DATA

5.1 INTRODUCTION

This chapter presents the results of the analysis of the case studies. The analysis of data involved 4 stages (Chapter Four). A summary of these procedures is given below:

- (i) A broad analysis and evaluation of skills evidenced in the 42 case studies in the South African texts.
- (ii) A broad analysis and evaluation of Constructivist teaching strategies evidenced in the 42 case studies.
- (iii) A specific, in-depth analysis and evaluation of four case studies, selected from the 42 case studies.
- (iv) A specific, in-depth analysis and evaluation of one case study selected from a British text.

5.2 THE ANALYSIS AND EVALUATION OF SKILLS IN THE CASE STUDIES

Table 5.1 shows the results of the analysis of skills in the 42 case studies. A total of 296 skills was determined from the analysis.

5.2.1 GEOGRAPHICAL SKILLS

The highest percentage (70,92%) of Geographical skills fell in the oracy/literacy category. Graphicacy skills accounted for 22,30 %, numeracy 4,06 % and fieldwork 2,72 %.

(i) Oracy/Literacy

The prominence of oracy/literacy skills(70,92 %), in relation to the poorly represented graphicacy, numeracy and fieldwork skills is most noticeable. Although the development of oracy/literacy skills is important, a more equitable distribution among all the Geographical skills is desirable.

TABLE 3.1
THE ANALYSIS OF SKILLS IN THE 42 CASE STUDIES
n = 296

OTHER SKILLS/OBJECTIVES		GEOGRAPHICAL SKILLS				TOTAL
		oracy/ literacy	graphicacy	numeracy	fieldwork	
		%	%	%	%	
PROCESS	factual recall	18,58	8,11	0,68	0	27,37
	comprehension	15,53	4,73	1,35	0	21,61
	application	10,47	6,41	1,35	0,68	18,91
	analysis	0,34	0,34	0,34	0,34	1,36
	synthesis	2,03	1,01	0	0	3,04
	evaluation	3,04	0,34	0,34	0	3,72
ATTITUDES	people	6,41	0,34	0	0,34	7,09
	environment	5,07	0,34	0	0,34	5,75
VALUES		6,41	0,34	0	0,68	7,43
INTERACTIVE SOCIAL SKILLS		3,04	0,34	0	0,34	3,72
TOTAL		70,92	22,30	4,06	2,72	100

(ii) Graphicacy

The poor representation of graphicacy skills (22,30 %) is particularly disturbing in the light of the fact that one of the most important aims of Geographical Education is the nurturing of such skills (Balchin, 1972). Furthermore, one way in which Geography as a discipline distinguishes itself from others is on the basis of graphicacy. It is significant that a number of case studies included graphical stimulus material, but failed to develop pupils' graphical skills by setting applications directly related to this material. Such stimulus material can therefore be regarded as superfluous.

(iii) Numeracy

Few applications developed the pupils' numeracy skills, and this is a cause for concern. The ability of pupils to be able to apply relatively simple mathematical and statistical procedures in

analysing case studies is of fundamental importance since such analyses provide:

- (a) For the development of a vital part of the pupils' Geographical skills;
- (b) The basis for offering sound evidence in support of their arguments and conclusions.

It would appear that in the light of the analysis, the authors of the case studies have generally placed little emphasis on the development of pupils' numeracy skills in these studies.

(iv) Fieldwork

Fieldwork skills accounted for the smallest percentage (2,72 %) of all Geographical skills and this is the most disturbing result. Fieldwork is one of the pillars of Geographical Education (Laws, 1984), and one might contend that fieldwork is the most important element in making the subject "real" for pupils. Fieldwork provides for the concretisation of abstract theory and also provides the opportunity for the development of a wide range of cognitive and affective skills. Case studies of environmental hazards, in particular, lend themselves to local fieldwork studies, and in South Africa today there are very few areas not affected by one or more environmental hazard. It was pointed out in Chapter Two that South Africa as a whole is potentially at risk to more than 25 hazards. Pupils therefore should be given the opportunity to undertake some form of fieldwork study in their immediate surrounds of a local hazard threat or hazard impact. Furthermore conducting a local case study of a hazard in the field is one of the most effective ways of making pupils more aware of their environment and of environmental problems. It also provides the opportunity for real-world involvement in issues and for participation in various actions to ameliorate or to solve such problems. The researcher believes that the scant attention given to case study fieldwork methods is inexplicable.

The heavy bias towards the development of oracy/literacy skills is

to the detriment of the development of as important graphicacy, numeracy and fieldwork skills.

5.2.2 OTHER SKILLS/OBJECTIVES

(i) Process Skills

The least complex (factual recall) process skills accounted for the highest incidence (27,37 %) of all skills, while the most complex skill (evaluation) accounted for a mere 3,72 % of all skills. It is generally accepted that the more complex, critical thinking skills are developed by the processes of analysis, synthesis and evaluation, which together accounted for only 8,12 % of all skills. Critical thinking skills are therefore very poorly represented, compared with the less complex skills of factual recall, comprehension and application, which accounted for 67,89 % of all skills. One of the main aims of Geographical Education, as reflected in the 1992 Syllabus, is the development of critical-thinking skills and one would expect that such an important aim would be realised to a much greater degree in the case studies.

One of the problems which the research revealed was the generally poor and incomplete wording of applications. The scant use of jussives (action words) such as "justify, analyse, distinguish, criticise", etc., creates difficulty for the pupil in knowing exactly what kind and level of answer is required. The researcher contends that the lack of clear and appropriate instructions by the authors results in pupils completing applications unsatisfactorily. In many cases the addition of jussives such as "justify, defend, explain your answer, criticise, and evaluate" after an initial question, would allow for the development of worthwhile critical thinking skills (Earle, 1980). Questions which simply required a yes or no response were particularly poor and needed completion in the form of a justification from the pupils. A simple yes/no response develops no skill at all, if no further justification is required.

(ii) Valuing Skills

Values were previously defined as "our standards and principles for judging worth" (Shaver & Strong, 1982:17). It is important to remember that values are not simply feelings or emotions, but have intellectual meaning that can be defined and clarified (Shaver & Strong, 1982). Values are thus both cognitive and affective.

The analysis of valuing skills in the case studies revealed a poor result compared with process (cognitive) skills. Valuing skills accounted for only 7,43 % of all skills. Hazard case studies have the potential to be used for a variety of issue-based values inquiry activities (see Fig. 2.8, Chapter Two), especially with regard to controversial people-environment issues. Pupils can be led to the analysis and clarification of their own values by examining the values of other. The research revealed, however, that in many cases the case studies were not approached from an issue-based perspective. An issue can be defined as a subject where numbers of people disagree about fundamental statements and assertions (Raw, 1989) based on their particular value stances. The proposed siting of a nuclear power station near a settlement would serve as a good example of a hazard which could be approached from a issue-based perspective, involving the examination and clarification of the values of the various interest groups and the pupils' own values. Such an approach would involve both cognitive and affective skills by the pupils and not only emotions or feelings.

Unfortunately, the majority of case studies analysed placed little importance on including material which could stimulate value enquiries of this kind, and this explains to some extent the paucity of valuing skills evident in the case studies. In addition, authors simply failed to take the opportunity to investigate values, even when the material offered scope for such analysis.

(iii) Attitudes

Although often confused with values, it was pointed out previously

that attitudes are not the same as values, but are a number of interrelated beliefs and feelings focused on some object (Shaver & Strong, 1982). Together, our values and beliefs determine our attitude towards something, and ultimately through attitudes find expression in behaviour (Raw, 1989). Attitudes are therefore value expressive (Slater, 1982).

The analysis revealed that skills developing attitudes accounted for 12,84 % of all skills. Skills developing attitudes towards people accounted for a slightly higher percentage (7,09 %) than skills developing attitudes towards the environment (5,75 %). As in the case of values, attitudes are both affective and cognitive and should be treated as a rigorous intellectual process, but this was not evident in the applications. In addition, case studies which provide only factual information on hazards, without the attendant human values and attitudes dimension, fail to educate pupils effectively about environmental problems. Considering that hazard studies are essentially people-environment studies, one would expect a far higher percentage of skills being devoted to the development of responsible and positive attitudes towards both people and the environment.

It is significant that some case studies included information on people's attitudes towards the environment, but the applications did not allow for much further investigation of such attitudes by the pupils. As a result of this, pupils were not led to question underlying values which gave expression to such attitudes and which ultimately resulted in certain types of behaviour or action. Pupils, therefore, were not given the opportunity to evaluate and review people's attitudes and actions with regard to their values. This in turn resulted in pupils not being able to review and also to develop their own attitudes towards a particular issue.

Skills developing pupils' attitudes therefore received generally superficial, unsatisfactory attention.

(iv) Interactive Social Skills

Opportunities for pupils to develop social skills were poor. Only 3.72 % of all skills fell into this category. While it is possible that teachers might adapt the case studies to suit their own needs, and introduce strategies which would promote the development of social skills, this cannot be taken as a rule. Only where explicit directions were given in the applications for group work, dialogues, etc., were they counted as applications promoting the development of interactive social skills.

The dearth of interactive social skills evident in the case studies is a significant shortcoming. It is only through pupils interacting with one another will they be given the opportunity to explore and develop their own ideas, having listened to the views of others. Interactive social skills are vitally important in developing an empathetic understanding of others' values and attitudes in particular. A case study of a hazard which promotes empathising with other people in different circumstances is ideally suited to the development of social skills. Pupils should be given the opportunity to explain and defend their own ideas and attitudes, and to review their ideas in the light of hearing the ideas and attitudes of other pupils.

Interactive social skills should also promote tolerance and understanding of other pupils cultures and ways of life, and the ability to work together in finding solutions to problems.

The case studies generally gave scant attention to the development of such vitally important skills.

5.2.3 THE ANALYSIS OF GEOGRAPHICAL SKILLS IN RELATION TO
PROCESS SKILLS, VALUES, ATTITUDES AND SOCIAL SKILLS

An important advantage of the matrix is the additional information yielded by each cell. This reveals information which would not be identified by a conventional table.

The cell which accounted for the highest percentage of all skills was the oracy/literacy/factual recall cell. In fact, within the oracy/literacy category, the less complex factual/recall, comprehension and application process skills accounted for 44,58 % of all skills. This clustering of a little under 50 % of all skills in only 3 out of a possible 44 cells must be seen as undesirable. A more even distribution among the cells would allow for the development of a wider range of equally and sometimes more important skills.

The predominance of factual recall, comprehension and application skills was also evident in the graphicacy and fieldwork categories. The first 12 cells therefore accounted for over two-thirds (68,89 %) of all skills. This figure emphasises the unsatisfactory distribution of skills in the 42 case studies, and the need for a wider distribution of skills among the remaining 32 cells, viz. more complex process skills, valuing and attitude skills and interactive social skills in the graphicacy, numeracy and fieldwork categories. While accepting that certain cells will of necessity have lower percentages than others, e.g., one would not realistically expect the values/graphicacy category to be as high as the factual recall/graphicacy category, one would expect a more equitable distribution among the skills as a whole, with certain cells commanding higher percentages, but not so overwhelmingly high.

5.3 THE ANALYSIS AND EVALUATION OF CONSTRUCTIVIST TEACHING STRATEGIES IN THE CASE STUDIES

Tables 5.2 and 5.3 show the results of the analysis of Constructivist teaching strategies in the 42 case studies. A total of 72 Constructivist teaching strategies was determined from an analysis of 194 applications based on the case studies.

TABLE 5.2
THE ANALYSIS OF CONSTRUCTIVIST TEACHING STRATEGIES
IN THE 42 CASE STUDIES
n = 72

CONSTRUCTIVIST TEACHING STRATEGIES		X
INTRODUCTORY/ EXPLORATORY ACTIVITIES	1. Brainstorming exercises	0
	2. Debates and discussions	5,56
	3. Role play	8,33
	4. Simulations and games	0
	5. Examining & reviewing evidence	20,83
	6. Examining & reviewing options	5,56
	7. Conducting experiments	1,39
	8. Conducting fieldwork	2,78
EXPLANATORY/ SOLUTION ACTIVITIES	1. Providing & explaining ideas	33,33
	2. Reviewing & evaluating ideas	1,39
	3. Providing & explaining solutions	8,33
	4. Reviewing & evaluating solutions	0
	5. Predicting outcomes/consequences	9,72
	6. Reaching group consensus	0
	7. Model design and explanation	1,39
	8. Scientific field research	0
TAKING ACTION	1. "Framework fieldwork"	0
	2. Writing reports and letters	0
	3. Involvement in real-world/local issues	1,39
TOTAL		100

TABLE 5.3
CONSTRUCTIVIST TEACHING STRATEGIES
RANK ORDER
n = 19

		X
1.	Providing and explaining ideas	33,33
2.	Explaining and reviewing evidence	20,83
3.	Predicting outcomes/consequences	9,72
4.	Providing and explaining solutions	8,33
4.	Role play	8,33
6.	Examining and reviewing options	5,56
6.	Debates and discussions	5,56
8.	Conducting fieldwork	2,78
9.	Conducting experiments	1,39
9.	Reviewing and evaluating ideas	1,39
9.	Model design and explanation	1,39
9.	Involvement in real-world/local issues	1,39
13.	Brainstorming exercises	0
13.	Simulations and games	0
13.	Reviewing and evaluating solutions	0
13.	Reaching group consensus	0
13.	Field research	0
13.	Writing reports and letters	0
13.	Framework fieldwork	0
TOTAL:		100

The Constructivist strategy most frequently encountered in the 42 case studies was providing and explaining ideas (33,33 %), followed by examining and reviewing evidence (20,83 %) and predicting outcomes/consequences (9,72 %) (Table 5.2). In most cases however, these strategies were individual exercises and were concerned only with developing literacy/oracy skills. Very few were in fact group exercises which would have promoted the development of a wider range of skills. In addition, the case studies failed to provide progressive strategies which would allow the pupils to work from the more basic explanatory exercises to the actual action stage which should be seen as an ideal culmination of preparatory exercises. This is evidenced by the nil or very low percentages for a number of explanatory and taking action strategies (Fig. 5.2).

The final strategy considered, that of involvement in real life issues, accounted for only 1,39 % of Constructivist strategies. This is a highly unsatisfactory result, bearing in mind the value of such an activity in developing value and attitude skills, interactive social skills and critical thinking skills. Such attitudes also allow the pupils to experience a real issue (hazard) in the field and the chance to grapple with the numerous intricacies of the dilemma. The weak results for both scientific field research and "framework fieldwork" points to the weak emphasis placed on fieldwork studies in general in the case studies. The potential for the development of numerous important skills from fieldwork exercises appears not to have received high priority from the authors.

Also poorly represented were reviewing and evaluation strategies, in particular those concerned with pupils' own ideas and with solutions (1,39 and 0 % respectively). These activities allow the pupil the opportunity to evaluate critically their own ideas and solutions in the light of further evidence and the ideas of others. In so doing, they reformulate their ideas and construct meaning for themselves. They are vital Constructivist strategies promoting

evaluative, critical thinking skills and the creation of real meaning for the pupils. Such an omission of the behalf of the authors is the case studies is a notable shortcoming in the light of Constructivist learning theory.

The absence of brainstorming exercises and simulations and games is another surprising omission by the authors. Brainstorming exercises in particular have become common exercises in textbooks today and are important as they sharpen skills, enabling pupils to think quickly, and promote an interchange of ideas. A simulation or a game based on a case study of a hazard is an ideal way of promoting a better and deeper understanding of an incident by involving the pupils in a real, meaningful activity. In addition, simulations encourage the development of more complex, critical thinking skills (Marsden, 1976). Role playing strategies were found (8,33%), but in every instance were confined to mental role playing. Cass (1993), for example, provides an excellent example of how a physical role playing exercise may be based on an issue-based case study, where pupils act out the roles of various interest groups (see Chapter2).

Table 5.3, which shows the rank order of Constructivist teaching strategies in this study, is revealing. What the researcher believes are the more demanding "taking action" strategies occupy the lower rank order positions, while the perhaps less demanding exploratory and explanatory exercises occupy the higher rank order positions. It is revealing, too, that the lowest rank order 13 is shared by no fewer than 7 strategies, all with zero percentages, and the second lowest rank order 9 is shared by 4 strategies, all with negligible 1,39 percentages. In contrast to the long "tail", are the high percentages held by the first and second rank order strategies, which together account for over 50 % of all Constructivist strategies. The researcher believes that this high percentage in the top orders is unacceptable and a better distribution amongst all the strategies, in particular the "taking action" strategies is desirable. The more demanding Constructivist strategies, which would promote the development of complex,

evaluative skills, are inadequately represented in the case studies.

In order to show the characteristics of satisfactory and unsatisfactory case studies, based on the evaluative criteria, four case studies will be discussed in detail in the next section.

5.4 THE ANALYSIS AND EVALUATION OF FOUR CASE STUDIES

The researcher selected two examples of satisfactory case studies and two of unsatisfactory case studies which were broadly analysed in the first stage. The two satisfactory case studies selected were:

- (i) The Laingsburg flood (in Swanevelder, C., et al., Junior Geography 7) (Appendix 5A).
- (ii) The earthquake hazard in San Francisco (in Gear, D., et al., Shuters Geography 7) (Appendix 5B).

The two unsatisfactory case studies selected were:

- (i) The 1988 Armenian earthquake (in Carr, D., et al., Successful Geography 7) (Appendix 5C).
- (b) The Mount St. Helens and Vesuvius volcanic eruptions (in Delaney, B., & Graham, D., Travel your world 7) (Appendix 5D).

5.4.1 THE ANALYSIS AND EVALUATION OF TWO SATISFACTORY CASE STUDIES

The two satisfactory case studies were chosen on the basis of their meeting an above average number of evaluative criteria, with regard to both skills and Constructivist teaching strategies. It was also the researcher's intention to select case studies which developed in particular more complex process skills in preference to less complex skills. Realistically, no case study can meet all the evaluative criteria, and the two examples chosen are in no way model case studies - they merely represent above average studies,

compared with the other 40 case studies.

(i) The Laingsburg Flood (Appendix 5A)

Tables 5.4 and 5.5 show the results of the analysis of the skills and Constructivist teaching strategies for the Laingsburg case study. The case study was chosen primarily for its wide range of process/Geographical skills, i.e., the range from factual recall to evaluation process skills in the three Geographical skill categories of oracy/literacy, graphicacy and numeracy.

Pupils are required to respond to questions of various levels of difficulty, based on an analysis and evaluation of textual information, diagrams and photographs. In so doing the pupils use a "web of skills" in responding to the data, i.e., different yet interrelated skills are used in responding to the questions. For example question (e):

Consider the information in fig 6.2 and the accompanying description and apply your own judgement in identifying all the factors that contributed to the cause of the flood (my underlining).

In this question the pupils are required to apply their knowledge to this particular situation, and to synthesise and evaluate the information presented in the figure and the accompanying text. Pupils thus are stimulated to examine and review the evidence/facts and to communicate and explain their ideas. The figure contains graphical and numerical information. Therefore, in answering the question the pupils develop a number of interrelated skills at the same time. This is a definite strength of this case study, as many of the case studies analysed develop different skills in a random and isolated way. Another strength of the case study is the clear instructions given to the pupils at the beginning of the exercise: "Study fig. 6.2 (p. 188) and the photographs (p.189) and consult an atlas to answer the following questions ...".

TABLE 5.4 SKILLS ANALYSIS :LAINGSBURG FLOOD CASE STUDY						
OTHER SKILLS/OBJECTIVES		GEOGRAPHICAL SKILLS				TOTAL
		oracy/ literacy	graphicacy	numeracy	fieldwork	
		No.	No.	No.	No.	
PROCESS	factual recall		2	1		3
	comprehension		2			2
	application	2	2	1		5
	analysis		1	1		2
	synthesis					
	evaluation	1	1	1		3
ATTITUDES	people					
	environment					
VALUES						
INTERACTIVE SOCIAL SKILLS						
TOTAL		3	8	4		15

TABLE 5.5 CONSTRUCTIVIST TEACHING STRATEGIES ANALYSIS: LAINGSBURG FLOOD CASE STUDY		
CONSTRUCTIVIST TEACHING STRATEGIES		No.
INTRODUCTORY/ EXPLORATORY ACTIVITIES	<ol style="list-style-type: none"> 1. Brainstorming exercises 2. Debates and discussions 3. Role play 4. Simulations and games 5. Examining & reviewing evidence 6. Examining & reviewing options 7. Conducting experiments 8. Conducting fieldwork 	2
EXPLANATORY/ SOLUTION ACTIVITIES	<ol style="list-style-type: none"> 1. Providing & explaining ideas 2. Reviewing & evaluating ideas 3. Providing & explaining solutions 4. Reviewing & evaluating solutions 5. Predicting outcomes/consequences 6. Reaching group consensus 7. Model design and explanation 8. Scientific field research 	1
TAKING ACTION	<ol style="list-style-type: none"> 1. "Framework fieldwork" 2. Writing reports and letters 3. Involvement in real-world/local issues 	
TOTAL		3

Such precise instructions are very important in directing the pupils to the correct stimulus material. The researcher found that poor instructions occurred frequently in the other case studies analysed. In these cases pupils are simply expected to respond to various stimulus materials, often presented in a disjointed manner over a few pages.

A weakness of this case study, though, is the lack of applications promoting valuing and attitude skills and the lack of group exercises. The researcher believes that exercises promoting these important skills need to be included in the case study, and could be done by rewording questions or by adding further questions.

(ii) The Earthquake Hazard in San Francisco (Appendix 5B)

Tables 5.6 and 5.7 show the results of the analysis for this case study. What is evident is the satisfactory distribution of complex process skills, valuing and attitude skills and interactive social skills. Geographical skills, however, are confined to the oracy/literacy group, with the exception of one graphicacy skill.

The strength of this case study rests in its combination of valuing and attitude skill with higher order process skills, linked to a variety of Constructivist teaching strategies. The newspaper cuttings provide excellent stimulus materials, showing different human responses to the 1989 earthquake, while the map provides graphical information on the area's geology, faults, the epicentres of the 1989 and 1906 earthquakes and various settlement features.

The first application based on the case study requires the pupils to write a report, based on an eye-witness account of an earthquake in the area sometime in the future. In doing so, the pupils adopt the mental role of a reporter, and base their reports on what they predict the most important impacts are most likely to be. The authors do not, however, specify what type of reporter is required, e.g., newspaper, radio, television, etc. In order to do this, the pupils firstly have to understand all the implications of a severe

TABLE 5.6 SKILLS ANALYSIS : SAN FRANCISCO (1989) EARTHQUAKE CASE STUDY						
OTHER SKILLS/OBJECTIVES		GEOGRAPHICAL SKILLS				TOTAL
		oracy/ literacy	graphicacy	numeracy	fieldwork	
		No.	No.	No.	No.	
PROCESS	factual recall	1				1
	comprehension					
	application		1			1
	analysis					
	synthesis	1				1
	evaluation	3				3
ATTITUDES	people	2				2
	environment	2				2
VALUES		2				2
INTERACTIVE- SOCIAL SKILLS		1				1
TOTAL		12	1			13

TABLE 5.7 CONSTRUCTIVIST TEACHING STRATEGIES ANALYSIS: SAN FRANCISCO (1989) EARTHQUAKE CASE STUDY			
CONSTRUCTIVIST TEACHING STRATEGIES			No.
INTRODUCTORY/ EXPLORATORY ACTIVITIES	1.	Brainstorming exercises	
	2.	Debates and discussions	1
	3.	Role play	1
	4.	Simulations and games	
	5.	Examining & reviewing evidence	1
	6.	Examining & reviewing options	1
	7.	Conducting experiments	
	8.	Conducting fieldwork	
EXPLANATORY/ SOLUTION ACTIVITIES	1.	Providing & explaining ideas	1
	2.	Reviewing & evaluating ideas	1
	3.	Providing & explaining solutions	
	4.	Reviewing & evaluating solutions	
	5.	Predicting outcomes/consequences	1
	6.	Reaching group consensus	
	7.	Model design and explanation	
	8.	Scientific field research	
TAKING ACTION	1.	"Framework fieldwork"	
	2.	Writing reports and letters	
	3.	Involvement in real-world/local issues	
TOTAL			7

earthquake in the region, which information they obtain from their own research, and from the stimulus materials. Secondly they have to predict the effects of a future earthquake based on a synthesis of the existing information. This means, too, that the pupils have to select what they consider to be most important in this respect based on their particular values. These values, in turn, will determine their attitudes towards man's predicament in this situation and also towards the effects on the environment. Such values and attitudes will be evident in their reports, implicitly or explicitly. This study is therefore an excellent example of the development of values and attitudes in a meaningful, stimulating exercise, where both cognitive and affective skills are integrated in one exercise.

The second part of the exercise, i.e., the class discussion provides an excellent opportunity for pupils to investigate and clarify their own values and attitudes and the values and attitudes of those people living in the San Francisco area. Pupils are required to examine and review their ideas based on three progressive questions, leading to a discussion which may develop an empathetic understanding of the people living in an earthquake hazard area. Pupils are required to place themselves in the position of native San Francisco residents, and are asked to respond to questions relating to reasons for living in the area. The pupils first response may be disbelief at why people choose to live in such an area but, after reviewing and evaluating their ideas, they may come to understand that people very often do not choose to live in the area but are victims of economic and personal circumstances which do not allow them to escape their situation. Pupils may also realise that the people of San Francisco do not perceive the hazard as being so severe as to necessitate living elsewhere.

This exercise has great merit as the pupils have to make use of both complex evaluative skills and valuing skills at the same time, in weighing up the reasons for living in a disaster-prone area. Also, by being involved in a discussion situation, the pupils

benefit from an interchange of ideas and the development of social skills.

A weakness of the case study is the disjointed manner in which the material is presented in the textbook. The applications and stimulus materials are disjointedly spread over seven pages, with information on other earthquakes interspersed in a random manner. The researcher believes that the publishers should attempt to keep all the case study materials together, so that the case study forms a coherent unit for study. This will aid the pupils' analysis and will not waste unnecessary time searching for relevant materials.

5.4.2 THE ANALYSIS AND EVALUATION OF TWO UNSATISFACTORY CASE STUDIES

The two unsatisfactory case studies were chosen on the basis of their below-average range of skills and Constructivist teaching strategies. In addition the researcher chose those case studies which promoted less complex process skills.

(i) The Mount St. Helens and Vesuvius Volcanic Eruptions (Appendix 5C)

Table 5.8 provides the results of the skills analysis. No Constructivist strategies were employed in the study hence no table is supplied. The exceptional feature of these two case studies is the paucity of applications based on relatively detailed accounts. The authors have produced adequate textual information, yet have based only two applications on this information. In addition, separate applications have not been set for the two case studies, but are based on a combined study of the two volcanoes. The researcher believes that the information provided in the case studies lends itself to a far wider range of separate applications, yet the authors have failed to capitalise on this opportunity. Furthermore, it is asserted that the summarising exercises set on the case studies develop only factual recall skills in the oracy/literacy group. Effective summarising applications should be

based on a synthesis of the pupil's own ideas in response to the information given in this text. This can be completed only after meaningful exploratory and explanatory activities have been undertaken. In addition, summarising applications need to be made more interesting and relevant to the pupils, such as the writing of reports, letters, memos, etc., in which the pupils encapsulate the main ideas of the topic under study. The researcher believes that the type of summarising exercise evident in this case study is ineffective in promoting complex critical thinking skills. The Mount St. Helens case study provides graphical information on the stages of eruption, yet no application is directly based on this. One cannot merely assume that the pupils will respond to the diagrams and will include relevant information in their summaries: clear instructions should be given or separate applications should be set on the diagrams in order to direct their attention to this graphical information.

TABLE 5.8 SKILLS ANALYSIS : MT ST HELENS AND MT VESUVIUS VOLCANIC ERUPTIONS CASE STUDY						
OTHER SKILLS/OBJECTIVES		GEOGRAPHICAL SKILLS				TOTAL
		oracy/ literacy	graphicacy	numeracy	fieldwork	
		No.	No.	No.	No.	
PROCESS	factual recall	2				2
	comprehension					
	application					
	analysis					
	synthesis					
	evaluation					
ATTITUDES	people					
	environment					
VALUES						
INTERACTIVE SOCIAL SKILLS						
TOTAL		2				2

In addition, the applications allow for no Constructivist teaching strategies. The researcher acknowledges, though, that certain strategies such as fieldwork and involvement in real-world issues are not feasible in South Africa for this case study and therefore no criticism can be levelled at such omissions in this case. Most case studies do, however, offer scope for some form of local fieldwork and involvement, especially those on environmental hazards (Chapter Two).

In terms of meeting the evaluative criteria which the study is capable of meeting, then, these two combined case studies were entirely inadequate.

(ii) The 1988 Armenian Earthquake (Appendix 5D)

Table 5.9 provides the results of the analysis of this case study. No Constructivist strategies were employed.

TABLE 5.9 SKILLS ANALYSIS : ARMENIAN (1988) EARTHQUAKE CASE STUDY						
OTHER SKILLS/OBJECTIVES		GEOGRAPHICAL SKILLS				TOTAL
		oracy/ literacy	graphicacy	numeracy	fieldwork	
		No.	No.	No.	No.	
PROCESS	factual recall		1			1
	comprehension	1				1
	application					
	analysis					
	synthesis					
	evaluation					
ATTITUDES	people					
	environment					
VALUES						
INTERACTIVE SOCIAL SKILLS						
TOTAL		1	1			2

Only two less complex process skills are developed in the three applications based on the case study. As in the case of the previous case study, the information provided, both textual and graphic, is adequate, yet the applications are not, in terms of the evaluative criteria applied.

A notable omission are applications developing valuing and attitude skills - although question 3 may appear to be developing such skills, it merely invites a yes/no answer, which in fact develops no skill at all. It might be conceded though that some pupils may respond to the question "Could people have been responsible for making the effects of the earthquake so bad?" more fully, but the researcher contends that if no justification for the answer is required, the majority of pupils will simply respond with a "knee-jerk" yes/no type answer.

In addition to this, the question is clumsily constructed and poorly worded. The use of the word "bad" is especially poor. More appropriate words to use in its place may be "disastrous", or "catastrophic". Also, a rewording of the question might invite a more carefully reasoned, fuller response, promoting both cognitive and affective skills, e.g., "To what extent might people have been responsible for the disastrous effects of the earthquake? Do you think that this is an acceptable situation or not? Give reasons for your answer."

Question 2 "Where was the epicentre of the Armenian earthquake?" is also poor, as contradictory, imprecise information is provided by the text and the map. The text suggests that the epicentre was directly below the town of Leninakan, yet the map epicentre points to the north-east of Leninakan. In addition, no explicit directions are given to the pupil to refer to either the text or the map or in fact to both. This type of vague question can only lead to contradictory answers, where the fault lies not with the pupils but with the poor phrasing of the question and the confusing information.

The researcher believes that far more adequate applications could be developed for this case study, but the authors have failed to spend sufficient time considering the range of possible responses to the applications. In general, then, it is suggested that more effort should be devoted to an evaluation of applications by both the authors and publishers of these case studies.

As a means of comparison the researcher analysed 1 case study selected from a British text.

5.5 THE ANALYSIS AND EVALUATION OF ONE CASE STUDY, SELECTED FROM A BRITISH TEXT

The researcher wished to select a case study which would:

- (i) be highly satisfactory in terms of meeting the evaluative criteria,
- (ii) point to the possible weaknesses of the case studies encountered in the South African texts.
- (iii) provide helpful ideas on how to develop more satisfactory case studies on South African hazards.

Accordingly, the researcher selected the study entitled "Disappearing soil - a case study of Lesotho" (Musgrove, A., Data Response for GCSE Geography) (Appendix 5E).

The study was chosen on the basis of meeting all the criteria above, and for the following reasons:

- (i) It is a case study on a southern African hazard, which should make it more relevant and interesting for pupils in this country.
- (ii) It can provide guidelines for the development of materials on local hazards. Of the 42 case studies analysed, only 15 dealt with South African hazards.

While one must recognise that the study is essentially aimed at

British GCSE level Geography and that a number of applications are very demanding, the researcher believes that this should not detract from any potential usefulness which the case study may have in providing ideas for authors, publishers and teachers in developing case studies in South Africa. Furthermore, the researcher contends that the studying of Geography in the junior-secondary level should not be any less demanding than in the senior level, and no excuse should be made for easy, simple applications in the junior levels based on the erroneous belief that these pupils are not able to cope with more demanding questions. Constructivist learning theory proposes that effective learning is, in fact, brought about by the use of complex, critical thinking skills (Chapter Two). Applications based on the case studies therefore need to be demanding in order to develop such skills, regardless of the level (junior or senior) at which they are aimed.

Tables 5.10 and 5.11 show the results of the analysis of the Lesotho soil erosion case study. What is immediately noticeable are the high incidences of both skills and Constructivist teaching strategies. A total of 56 skills and 23 Constructivist strategies was determined from the analysis. In addition to the high numbers, the skills and strategies were spread across a wide range.

The skills analysis revealed a high incidence of synthesising process skills in particular, distributed in the oracy/literacy, graphicacy and numeracy categories. Valuing and attitude skills were well represented.

The strategies analysis showed a high incidence of strategies relating to the communicating and explaining of ideas and occurrences of role play and simulations. The use of simulations and games and was not encountered in any of the 42 South African case studies. Notable too is the use of a model design strategy.

The Lesotho case study provides a detailed account of the soil erosion problem in that country and involves the pupils responding to a wide variety of applications. The case study begins with

TABLE 5.10
SKILLS ANALYSIS : LESOTHO SOIL EROSION
CASE STUDY

OTHER SKILLS/OBJECTIVES		GEOGRAPHICAL SKILLS				TOTAL
		oracy/ literacy	graphicacy	numeracy	fieldwork	
		No.	No.	No.	No.	
PROCESS	factual recall		6	1		7
	comprehension	1				1
	application	5	4	2		11
	analysis					
	synthesis	7	9	3		19
	evaluation	2				2
ATTITUDES	people	5				5
	environment	5				5
VALUES		5				5
INTERACTIVE SOCIAL SKILLS		1				1
TOTAL		31	19	6		56

TABLE 5.11
CONSTRUCTIVIST TEACHING STRATEGIES ANALYSIS:
LESOTHO SOIL EROSION CASE STUDY

CONSTRUCTIVIST TEACHING STRATEGIES			No.
INTRODUCTORY/ EXPLORATORY ACTIVITIES	1.	Brainstorming exercises	
	2.	Debates and discussions	1
	3.	Role play	2
	4.	Simulations and games	1
	5.	Examining & reviewing evidence	2
	6.	Examining & reviewing options	1
	7.	Conducting experiments	
	8.	Conducting fieldwork	
EXPLANATORY/ SOLUTION ACTIVITIES	1.	Providing & explaining ideas	8
	2.	Reviewing & evaluating ideas	1
	3.	Providing & explaining solutions	1
	4.	Reviewing & evaluating solutions	2
	5.	Predicting outcomes/consequences	3
	6.	Reaching group consensus	
	7.	Model design and explanation	1
	8.	Scientific field research	
TAKING ACTION	1.	"Framework fieldwork"	
	2.	Writing reports and letters	
	3.	Involvement in real-world/local issues	
TOTAL			23

introductory mapwork activities (Question 2) which familiarise the pupils with the country's location in southern Africa, and its weather patterns. The second part of the case study examines the problem of population pressure on unsuitable agricultural land and how this has led to over-cultivation and overgrazing (Questions 3,4,5,6). The pupils are involved in interpretative and prediction exercises based on their own mapping and graphing exercises. It is significant that the pupils are led to analyse and synthesise the information on based on their own maps and graphs and to base their conclusions and forecasts on this information. The pupils thus make use of a web of process and Geographical skills in responding to the graphical data which they has drawn for themselves.

The final part of the study involves role play and a simulation exercise where the pupils are led to investigate and evaluate the different value positions of the people whose role they are playing. The pupils are presented with various issues surrounding the problem of soil erosion on a simulated farm in Lesotho where difficult decisions have to be made regarding the future development of the farm. Pupils gain insight into the dilemma in a meaningful way, as they are exposed to conflicting viewpoints and values embodied in the roles of the peasant Koro family and the government extension officer. It is important, too, that the pupils base their responses on accurate and realistic textual and graphical information. This makes the exercise more plausible for the pupils but also involves critical thinking skills of analysis, synthesis and evaluation. They are not simply playing roles based on a "make-believe", "anything goes" situation. Pupils are led to evaluate and review their plans and proposals in the light of further discussions and after careful consideration of the views of the peasant farmers and the government officer. In this way pupils develop an empathetic understanding of those involved in the issue. In all questions the pupils are required to justify their ideas and views and this raises the level of response needed, from the less complex to the more complex evaluative level.

The researcher believes that this case study exemplifies an above-

average case study. The study has:

- (i) a wide range of skills (in particular higher order process/Geographical and valuing/attitude skills)
- (ii) a wide range of Constructivist teaching strategies
- (iii) a selection of interesting, accurate and meaningful stimulus material
- (iv) precisely worded applications
- (v) a logical, sequential investigation of the various issues. The enquiry method of learning (Fig. 2.8) (Chapter Two) is thus evident in this approach.

It is apparent from this analysis and discussion that the authors and publishers of case studies in South Africa need to evaluate the effectiveness and educational value of those presently available in the country. The researcher believes that much can be learned from the Lesotho case study and from numerous other studies available in British texts today. In addition, the researcher's skills evaluation matrix (Appendix 4D) and Constructivist teaching strategy evaluation table (Appendix 4E) could be used as an aid in developing more satisfactory case studies locally.

5.6 SUMMARY

The analysis and evaluation of the 42 case studies in South African texts revealed the following shortcomings:

- (i) The heavy bias towards the development of oracy/literacy skills.
- (ii) The inadequate emphasis given to the development of complex, critical-thinking skills.
- (iii) The dearth of strategies promoting the development of positive values and attitudes towards people and the environment.
- (iv) The scant attention given to the development of interactive social skills.
- (v) The lack of more demanding and more advanced

Constructivist teaching strategies, such as the "taking action" strategies.

The two satisfactory case studies selected for the detailed analysis, however, provided evidence of reflecting the current aims of Geographical Education and learning theory more satisfactorily.

The analysis and evaluation of the case study from the British text, however, satisfied a far greater number and range of evaluative criteria, in comparison with the case studies in South African texts. A positive link was found with regard to the use of Constructivist teaching strategies and the development of critical thinking skills and valuing skills. This result points to the shortcomings of the South African case studies.

The British case study analysed in this chapter, and those to be found in the British texts discussed in Chapter Two can provide helpful guidelines for developing more satisfactory local case study teaching materials on South African hazards. While it is accepted that pupils need to learn about hazards in all parts of the world, and that examples of overseas hazards need to be included in South African texts, local hazards, of which there are numerous, should receive greater prominence in South African texts.

CHAPTER SIX
CONCLUSION AND RECOMMENDATIONS

6.1 INTRODUCTION

This study focused on case study teaching materials related to hazards, as presented in South African and British texts. The primary aim of the research was to evaluate the extent to which these materials are optimising the opportunities available for effective teaching and learning, with the Environmental Paradigm. Evaluation criteria were based on the current aims of Geographical Education and current learning theory, in particular the theory of Constructivism.

It was shown in Chapter Two that the teaching of case studies of hazards in Secondary School Geography has the potential to achieve a number of important aims, which are reflected in current Geographical thinking and in learning theory. These aims are concerned with the development of critical thinking, problem solving skills, and with the fostering of responsible attitudes towards the environment. The development of critical thinking skills as an essential skill in finding solutions to ever-increasing environmental and human problems, is seen as one of the most important utilitarian aims of Geographical Education (Fien, Gerber & Wilson, 1984).

This must, however, be seen against research in a South African context, which claims that teachers are not sufficiently well trained in pupil-centred participatory teaching strategies (Ledger, 1977, Ballantyne, 1986; van Harmelen, 1991) and this mitigates against effective teaching. In the light of the evidence that the textbook is possibly the most important tool in South African teachers' hands today (Diepeveen, 1982; Mophiring, 1983), textbooks ought to include materials and strategies reflecting current learning theory (Nightingale, 1974). Research, however, has revealed shortcomings with regard to South African Geography textbooks (Mophiring, 1983; Drummond & Paterson, 1991; Rulashe,

research in progress).

The evaluation was conducted with the aforementioned in mind.

6.2 THE RESULTS OF THE STUDY

Chapter Three examined various approaches towards educational evaluation. It was suggested that approaches and models may be placed on a continuum, ranging from those which are inclined towards a positivistic paradigm to those which are naturalistic in orientation. The present study fell approximately midway along the continuum, as it was concerned with describing both the processes and products of the teaching/learning situation. In addition, the researcher used both quantitative and qualitative methods of evaluation.

The examination of materials evaluation methodologies revealed a diverse range of aims, objects, methods and evaluative criteria. Weaknesses were found with regard to poor theoretical frameworks and single evaluation methods. Methods proposed by Garcia & Armstrong (1979), Maccoll (1984), Hutchinson (1987) and Pomerantz (1991) provided valuable ideas for the evaluation methodology adopted in this study.

The methodology applied in the study (Chapter Four) therefore represents an eclectic combination of ideas gleaned from the studies mentioned above and methods specifically developed for this study. It is the researcher's belief that the evaluation methodology devised for this study has provided a valuable tool which may be used for further research in education in South Africa today. Accordingly, a four-stage research procedure was devised in order to meet the aims of the evaluation.

The analysis of the 42 case studies revealed the following problems in the presentation of hazards in the texts:

- (i) The Geographical skills of graphicacy, numeracy and

fieldwork were poorly developed, in relation to the development of oracy/literacy skills. Fieldwork skills in particular received very little attention.

- (ii) Insufficient emphasis was given to the development of complex, critical thinking skills. The development of factual recall skills predominated.
- (iii) Exceptionally poor attention was given to the development of interactive social skills.
- (iv) Inadequate emphasis was placed on activities promoting the development of values and responsible attitudes towards people and the environment. Thus there was little evidence of the use of the case studies as a vehicle for effective Environmental Education.
- (v) More demanding and advanced Constructivist teaching strategies were exceptionally poorly represented. This proved to be a notable shortcoming, in the light of the value of such strategies in encouraging actual involvement in real-world, local issues. Most case studies offered strategies which did not progress further introductory and explanatory ones.
- (vi) A number of applications were characterised by poor wording and a lack of clear and precise instructions.
- (vii) The majority of the case studies examined overseas examples of hazards. This bias towards the inclusion of overseas hazards in South African texts is indicative of the lack of availability of well researched studies of local hazards.

Two case studies selected for the detailed analysis however provided evidence of reflecting the current aims of Geographical Education and learning theory more satisfactorily.

In general, though, the 42 case studies analysed gave little evidence of optimising the opportunities for effective teaching/learning and for Environmental Education. One might conclude, therefore, that a poor "match" existed between the evaluative criteria and the materials. This, in turn, points to an

inadequate reflection of the 1992 Syllabus aims in the teaching materials.

In contrast, the analysis of the case study from the British text showed that it met a far greater number and range of criteria than the South African case studies did. Skills were developed across a broad range, by the use of a variety of Constructivist teaching strategies. A positive link was found between the use of Constructivist teaching strategies and the development of critical thinking skills.

The British case study therefore provided a more satisfactory match with the evaluation criteria, compared with the South African studies. This case study, and those contained in the British texts analysed in Chapter Two, can provide useful guidelines for the development of local case study teaching materials on South African hazards.

6.3 RECOMMENDATIONS ARISING FROM THE STUDY

The results of this study have pointed to a need for:

- (a) The development of materials in textbooks which will not only lead to effective learning on the part of pupils, but will also provide guidelines for teachers to achieve the current aims of Geographical Education. Such guidance is sorely needed during the period of transition and increasing budget reductions, which could lead to a shortage of educational resource packs and other teaching materials.
- (b) Educating teachers with regard to the selection, evaluation and use of educational materials and textbooks.

In the light of these needs, and in view of the shortcomings associated with materials evaluation methods, it is suggested that the methodology devised for this study may be utilised in the following manner:

- (i) Teachers may use the skills evaluation methodology applied in this study to develop more satisfactory applications based on case studies specifically, but also on any section of Geography.
- (ii) Teachers may use and adapt the evaluation methodology to evaluate a range of subject textbooks, which need to be purchased by the school. This is seen as particularly important in the light of recent developments with regard to the increasing autonomy given to schools in this country. The responsibility will rest with teachers in choosing appropriate textbooks in the future.
- (iii) Teacher education and in-service teacher education institutions may utilise the methodology to teach students and teachers about textbook evaluation methods.
- (iv) Textbook writers, editors and publishers may employ the evaluation methodology to develop more satisfactory applications in South African Geography textbooks.
- (v) Local case study materials on a variety of South African topics, but on South African hazards specifically, should be researched and developed, and be made available to teachers in this country. Case studies available in British texts and the methodology used in this study can provide guidelines for developing these materials.

In addition, research has pointed to the need for improvements in teacher training (Ledger, 1977; Ballantyne, 1986). Improvements in Geography textbooks therefore cannot occur in isolation: they must be linked to an overall programme of improving teachers' perceptions of modern methods in Geographical Education. Van Harmelen (1991) thus suggests five ways to improve teachers' perceptions of learner-centred teaching strategies and to encourage the wider use of such strategies, viz. :

- (i) A journal or bulletin designed specifically for South African Geography teachers.
- (ii) In-service courses for teachers.
- (iii) Local Geography study groups.

- (iv) Publications which are accessible to all teachers.
- (v) A data base of current Geographical information.

The researcher believes that these recommendations need to be reaffirmed in the light of the results of this research. The recommendations offer improved ways for practising teachers and student teachers to remain abreast of current developments in Geographical Education.

It is believed that information concerning current trends in the use of textbooks should be disseminated to teachers via the various sources as suggested by van Harmelen (1991).

The focus of this study rested on an evaluation of applications based on the case studies of hazards. A number of unintended outcomes, which were not foreseen in the initial formulation of goals, highlights the need for further research in the field of Geography textbooks in South Africa. A need is thus seen for further research with regard to:

- (i) The choice of textbook evaluation criteria and the use of methods of evaluation by Geography teachers in South Africa.
- (ii) The development of appropriate "teacher friendly", yet theoretically sound textbook evaluation methods.
- (iii) The presentation of materials in Geography textbooks.
- (iv) The educational publishing industry in South Africa, with special reference the role played by textbook writers, educational authorities and institutions within the industry. The researcher is of the opinion that South African Geography textbooks are a set of compromises among conflicting forces (Maxwell, 1985) and that financial considerations, politics and hidden agendas play an important role in determining the quality and suitability of Geography textbooks available in this country.

6.4 THE PERCEIVED LIMITATIONS OF THE STUDY

- (i) Evaluative research is by virtue of its nature necessarily subjective, to a lesser or a greater degree. The researcher concedes, therefore, that an element of subjectivity is unavoidable in this study.
- (ii) The methodology employed in the research was extrapolated from an analysis of models and approaches, in educational evaluation in order to find an appropriate methodology for this study. The methodology and the evaluative criteria may therefore be criticised on the grounds of being idiosyncratic and too narrowly defined, with limited potential for use by other researchers in similar evaluations. The researcher contends, however, that in the light of the methodology used, this is not the case and that this evaluation methodology may have considerable value to be used and adapted by other researchers in the future. It is believed that the approach adopted in this study is novel and innovative, and may be adapted to suit the different needs of researchers, teachers and textbook writers, not only in the field of Geography, but in other fields too.
- (iii) The evaluation focused on a small section in the Geography textbooks. The results of this study are therefore limited to only this section, and therefore a wider generalisation of the results is not valid.

6.5 CONCLUSION

Change is the only certainty in the South African educational scenario today. Faced with the task of redressing historical educational imbalances, educators in every field of education will have to meet new challenges as part of the process of transition. An important challenge is that of changing teachers' perceptions with regard to modern trends in educational thinking. In this regard, Geography teachers must be made aware of the advantages of using modern teaching strategies in the classroom.

The use of sound textbooks is one way of alleviating the pressures associated with rapid educational change, and of changing teachers' perceptions. Educationally sound textbooks have the potential to help teachers to become more familiar with modern views of learning, and will also benefit pupils who are encouraged to think critically and independently. Properly researched, well-developed case studies of hazards, reflecting current learning theory and current thinking in Geographical education have the potential to meet a number of changing needs in education today, and specifically in Geographical Education.

This research has provided some insights into the exceptionally broad field of textbook evaluation, and it is hoped that the utilitarian findings of the research may ultimately benefit the "end-users" of these materials.

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APPENDIX 2A
 THE 1992 CAPE EDUCATION DEPARTMENT JUNIOR SECONDARY COURSE SYLLABUS
 FOR GEOGRAPHY ORDINARY GRADE:
 PRINCIPLES AND AIMS AND THE
 SYLLABUS CONTENT ON HAZARDS FOR STD. 7.

1. PRINCIPLES ON WHICH THE CURRICULUM IS BASED

1.1 The nature of Geography

Geography studies the relationship between man and his physiocultural environment. As such it has many areas of overlap with other subjects in both natural and social fields, especially as far as learning contents are concerned. However, Geography has its own perspective on these learning contents. Therefore this subject curriculum provides for

1.1.1 the use and emphasis of various viewpoints such as

- * the man-environment relationship
- * the spatial perspective
- * the regional approach

1.1.2 a balance between Physical and Human Geography

1.1.3 continuous integration of practical aspects with the theoretical aspects

1.1.4 sufficient flexibility to allow for the changing nature of the subject

1.1.5 ample opportunities for the teacher to emphasise, inter alia, the following basic principles of the subject:

- * A global image or a holistic approach

It is of vital importance that the components of the curriculum should be viewed as parts of a greater unit and not as isolated compartments.

- * Spatial differentiation

A study of the spatial aspects of the environment which is characterised by continuous change in form and pattern

- * Causal relationships

A study of the factors, reasons, functions and processes responsible for the changes

- * Man-land relationship

Especially the significance of issues for man

1.2 General education of the pupil

Education is concerned with the development of the 'whole human being'. The curriculum should therefore

1.2.1 help to achieve the following aims in the long term:

- * The development of intellectual skills and abilities of pupils to promote on-going education
- * The adjustment of pupils to a society that is undergoing rapid and far-reaching social, economic and political changes
- * The entering of a world-at-work that is becoming increasingly technologically orientated
- * The development of moral and emotional (affective) attributes of pupils in order to enable them to maintain themselves in a demanding world

1.2.2 be directed towards both a specific vocationally-orientated and a university-orientated approach in order to provide for the following three groups of pupils:

- * Those who will receive no further instruction in the subject after the junior secondary phase
- * Those who will receive no further instruction in the subject after the senior secondary phase
- * Those who will continue with the study of Geography at tertiary level

1.2.3 relate the junior secondary phase with the senior primary and secondary phases in order to bring about a progressive development of geographical insight, skills and abilities.

2. AIMS AND OBJECTIVES

- * In lesson preparation and planning teachers should bear in mind the higher abilities of comprehension, analysis, synthesis, evaluation and application.
- * The affective domain (attitudes and values) should receive the necessary attention.
- * This subject should be taught in such a way that pupils develop an eagerness for further study and individual research.
- * Teachers should be aware of the contribution Geography can make to the general education of the pupils. It is this awareness that gives direction to day-to-day teaching.
- * Short-term objectives selected for a lesson should be closely correlated with the aims of the subject and the resources available.

- * Objectives should be meaningful to teachers and pupils alike, and must be realistic and achievable. Learning objectives should therefore be formulated in terms of clearly defined verbs and should be evaluated regularly.

- * Aims may be classified into a few main categories:

2.1 Observation

The way in which the environment is "perceived" in relation to the "actual" environment, influences the pupil's concept of space (spatial conceptualisation).

In order to heighten the pupils' perception of their environment, it is necessary for them repeatedly to

- * measure and identify spatial characteristics and patterns such as distance, location, direction, height, depth, distributions and different intensities
- * recognise the world's place-to-place variety and the uniqueness of a place
- * consult audio-visual teaching media, source materials and other conveyors of information to obtain factual information.

2.2 Exposition of relationships

Pupils should be able to elucidate and explain the observed spatial characteristics of the environment (differences, similarities and changes) in terms of particular functions and processes. A search for reasons and factors responsible for the changing reality exposes specific relationships and provides pupils with the necessary practice in interpretation, conceptualisation and the stating of relationships.

2.3 Skills

2.3.1 No list of capabilities can be complete. The following should, however, be kept in mind:

- * The importance attached to different skills should be related to the abilities and maturity of the pupils.
- * The acquisition of skills should enable pupils to deal with the observed facts in an organised manner.
- * Pupils should gain proficiency in the use of skills through repetition and the application of the abilities in new situations.

- * Pupils should acquire the skills to study the spatial aspects of social and economic problems. Such studies provide pupils with opportunities to respond to situations in which problems could be solved and decisions made by way of critical, divergent and creative thinking.

2.3.2 Geography makes a particular contribution to the attainment of the following skills:

- * Oracy and literacy: to think logically, to write concisely and to speak with assurance and accuracy
- * Numeracy: illustration by means of simple statistical methods, graphs and tables
- * Graphicacy: the ability to draw, read and interpret
- * Interpretation: pictures, photographs and maps
- * Fieldwork techniques: using either the traditional (surveys) or the scientific approach

2.4 Appraisal

2.4.1 Studies in Geography should promote and reinforce positive attitudes and values.

2.4.2 Pupils need to develop a social awareness. This means that they will be expected to

- * recognise the interdependence of man
- * acquire a tolerant attitude towards others with different social, economic and political circumstances.

2.4.3 Pupils should have environmental awareness and a commitment to the environment by developing a 'caring attitude'. This means that they will be expected to

- * realise that conservation is essential
- * understand that the balance of nature is largely dependent on man's wise management of his environment.

2.4.4 Pupils need to develop worthwhile attitudes towards learning, for example: respect for evidence; a critical appraisal of reporting; a suspicion of simplistic explanations and a willingness to exchange opinions.

2.4.5 Pupils need to be able to distinguish between central issues of importance and peripheral issues.

2.4.6 Pupils should realise that the quality of life is influenced by the aesthetic aspects of man's environment as well as by an appreciation of the grandeur and wonder of Creation.

2.5 Mastering the content

Practising of the above learning objectives should contribute to the mastering of fundamental factual knowledge.

3. TEACHING GUIDELINES

3.1 Teaching approaches

Teachers should create effective learning experiences for their pupils. It is necessary to attempt to create a sense of reality in the teaching situation, irrespective of the teaching approach used.

3.1.1 The holistic or global approach

- * The components of the course should be viewed as parts of a whole.
- * Wherever possible, the relationship and interaction between components should be stressed.

3.1.2 The descriptive versus the problem-solving approach

- * Although there is still place for traditional descriptive Geography, more emphasis should be given to a problem-oriented approach. Systematic studies should therefore be replaced by a thematic approach more frequently.
- * Pupils should be trained in the scientific method of research (statement of hypothesis, followed by the collection and classification of information, and finally, the testing of the hypothesis).
- * Pupils should gain insight into the process of decision making by participation in, for example, simulation games and role play.

3.1.3 The thematic approach

3.1.4 The inter-disciplinary approach

- * Concepts studied in Geography may overlap with those of other subjects such as Biology, Science and Economics.

- * Inter-disciplinary studies should form part of the broad teaching strategy. This will increase the value of both the learning content and the learning objectives.
- * Notwithstanding the overlap with other subjects, studies should always be undertaken from a geographical perspective.

3.2 Teaching aids and techniques

It is recommended that teachers should, inter alia,

3.2.1 integrate the reading and interpretation of video films, photographs and maps like the following with the relevant section of the curriculum:

- * Photographs: vertical, oblique (i.e. aerial and ordinary photographs)
- * Satellite images
- * Maps: wall, atlas, topographic maps of Southern Africa (particularly the 1:50 000 SA Series) and municipal maps of the local area
- * Film material, videos, slides, transparencies

3.2.2 ensure that pupils become competent in the use of various measuring instruments and other apparatus. Emphasis should be placed on the information gathered and not on the mechanism of the instruments. Computers may also be used in this respect.

3.2.3 make use of diagrammatic representation of statistics, e.g. population characteristics can be explained with the aid of segments of a pie-graph.

3.2.4 make use of physical models such as globes, tellurians, paper mâché/sand tray models and other realistic means

3.2.5 undertake well-planned and meaningful fieldwork

- * This includes observation and measurement in the field; note-taking and calculations in the field; the interpretation of written and graphical information and reaching conclusions.

3.2.6 encourage individual and group research techniques

- * Throughout the year pupils should undertake short independent study tasks on work related to the requirements of the syllabus.

3.2.7 make use of the media centre.

3.3 Differentiation

3.3.1 Most of the topics studied are common to all grades. However, pupils in different grades will not be expected to study these in the same depth. The approach in Lower Grade should be more simple, concrete and perceptible. More observational activities and less application should be done by these pupils.

3.3.2 Teachers should not expect the same amount and quality of work from all pupils, even though they are in the same standard and grade. However, each pupil should be expected to work at the highest possible level of his own ability.

3.4 Evaluation and assessment

- * There should be continuous assessment in all standards to determine pupil progress and to implement remedial teaching when required.
- * Appropriate assessment techniques should be used to determine whether the pupils have achieved the expected aims and objectives (see par. 2).
- * Evaluation is also concerned with the determining of the effectiveness of lesson planning, classroom management and the achievement of lesson objectives.

CORE SYLLABUS CONTENT	DETAILED CONTENT	COMMENTARY
<p>2.2.4 The growth of urban settlements and the birth of metropolitan areas and megalopolis</p>	<ul style="list-style-type: none"> - Growth tendencies; statistics; uneven distribution and patterns of settlement - The problem of urbanisation and its implications - <u>Problems</u> (examples) living-space; services, air pollution; noise; waste; traffic congestion; organisation; human diversity and urban planning as problems to be taken into account 	<ul style="list-style-type: none"> - Urban areas should be visited and land-use zones identified. - Structured fieldwork and field studies of the LOCAL environment should be done. - South African examples should be emphasised to explain the concepts "metropolitan areas" and "megalopolis".
<p>3. NATURAL HAZARDS, PRE-CAUTIONARY MEASURES AND COMPENSATION</p> <p>Discuss TWO of the following four categories of natural hazards:</p>		
<p>3.1 Natural hazards owing to catastrophic weather conditions</p>		<ul style="list-style-type: none"> - The human factors should be emphasised. - Where possible, refer to South African examples. - Integration of mapwork, use of atlases, sketches, structured fieldwork, audio-visual teaching media and the utilisation of media reports should characterise the teaching.
<p>3.1.1 Droughts</p>	<ul style="list-style-type: none"> - Areas of occurrence and consequences 	
<p>3.1.2 Winds</p>	<ul style="list-style-type: none"> - Cyclones, typhoons and hurricanes: important areas of occurrence and consequences 	
<p>3.2 Natural hazards owing to internal (endogenetic) earth forces</p>		
<p>3.2.1 Volcanoes</p>	<p>Volcanic activity</p> <ul style="list-style-type: none"> - Magmatic extrusions and lava flow - Volcanic ash rain - Extinction of life by toxic gases - Catastrophic mudflows 	<ul style="list-style-type: none"> - Refer to historical and more recent examples (such as Pompeii and Herculaneum; Surtsey; Iceland; Cameroon; Western Africa (1986-08-21); Colombia; Mexico City; Chili; New Zealand; Alaska; Turkey; Tristan da Cunha and Mt. St. Helens).
<p>3.2.2 Earthquakes</p>	<ul style="list-style-type: none"> - Nature and characteristics - Intensity - Earthquake zones - Consequences - Detection of tremors and shifts which may precede earthquakes 	<ul style="list-style-type: none"> - Refer to South African and a few foreign examples, e.g. those in South Western Cape (i.e. Boland) and along the San Andreas fault in California.

CORE SYLLABUS CONTENT	DETAILED CONTENT	COMMENTARY
3.3 Natural disasters owing to external (exogenetic) earth forces		<ul style="list-style-type: none"> - The ingenuity of man to develop precautionary measures to combat the effects of these hazards should be stressed. - Reference to seismological stations and early-warning tropical cyclone tracking centres and the warnings to evacuate homes and offices given to people through communication media, should be emphasised.
3.3.1 The force of fast flowing water	- Floods	- Attempts should be made to illustrate or present the contents in a realistic way.
3.3.2 Powerful subsidences	- Catastrophic subsidences, e.g. sinkholes in Karst regions	- Integration of mapwork and illustrated source materials should characterise the teaching.
3.3.3 The force of ice and snow in motion	- Avalanches in mountain areas - Icebergs	- Precautionary measures should be discussed.
3.3.4 Wind as a powerful force in transporting particles and destroying forms of life	- Advancing coastal dunes and desertification	
3.4 Disasters caused by man		
3.4.1 Explosions at nuclear power stations and the consequences	- Radio-activity and radiation	- The precautionary measures should be discussed.
3.4.2 Large-scale ecological disturbances caused by pollution and over-exploitation of resources	- Examples of recent explosions at nuclear power stations and the consequences	
3.4.2 Large-scale ecological disturbances caused by pollution and over-exploitation of resources	- Toxic gases and acid rain - Pollution of rivers and oceans - Over-exploitation of resources	- Refer to measures to prevent and combat ecological disturbances, as well as attempts to restore conditions.
4. BIOGEOGRAPHY		
A general survey of the world's main	- Essence and particular perspective of the subject Biogeography, a field of study that bridges the fields of Biology and Geography	- The integration of mapwork, source materials, statistical data and audio-visual teaching media should be characteristic of the teaching.
- tropical forests (equatorial and monsoon)		
- coniferous forests		
- tundra and icecap regions according to the following headings:		
- Major biomes of the world	- Elementary division of the world into major biomes	
- Location, size and world distribution	- Location and character of a certain biome	- The atlas should be used.

APPENDIX 2B
ROBERSON AND LONG'S SAMPLE STUDY METHOD
SOURCE: ROBERSON & LONG, 1956:252-257

Ideally, complete cover of a place, by map, picture, statistical and descriptive records is desirable, but this is often not available. The example which follows is deliberately based on minimum material from a standard text on Japan,¹⁷ and for teaching purposes has been located in Nara prefecture, where villages closely resemble the one selected. The original work on which Trewartha's study is based is described by Shiroshi Nasu, Professor of Rural Economy in the University of Tokyo, as representative of Japanese agriculture. Nara can be found in the *Oxford* (or any similar) *Atlas*. The main purpose of the map given here (Fig. 1) is to indicate the geographical limits of the region represented by the sample. Older children might well themselves use these boundaries to delimit the region. For the purpose of third-year school geography, the limits can be set by a simpler statement such as is indicated in section ten of the lesson, which is intended as the first of three or four normally available for Japan in the grammar school syllabus which often presents Asia in a third-year course. A second lesson, consolidating the study, possibly with the help of pictures (such as in frames 11-21 of Common Ground filmstrip CGA 639, *Japan*, by R. C. Honeybone), should be directed towards summarizing the general features of Japanese agriculture, with special reference to climate and topography.

The aim of the lesson is to show human response to environment in rural Japan. The equipment required is a sample study map (Fig. 2)

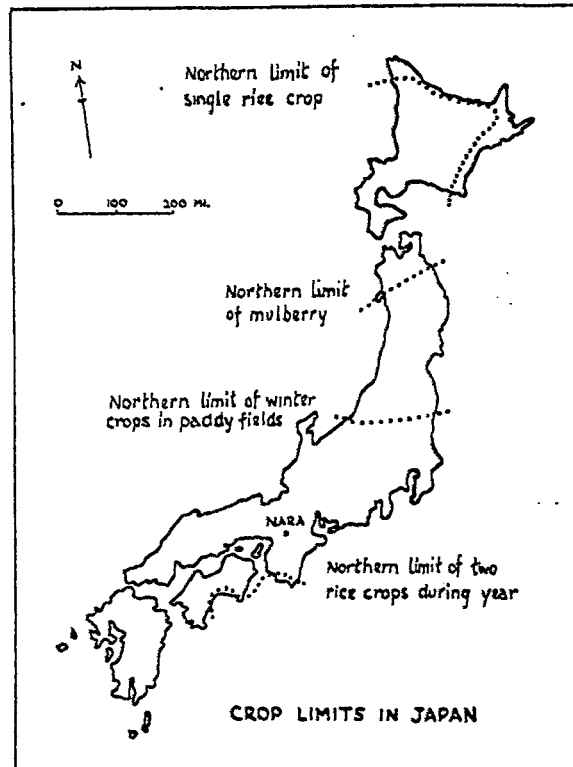


Fig. 1. (After Trewartha.)

for each child, atlases, the descriptive passage for reading aloud, and farmer's budget figures (Table I).

The lesson is as follows:

1. On the blackboard is the budget of an average Japanese farmer. What is his total income in yen? Total expenditure? What do these totals tell us? (He spends more than he earns.)* The actual figures are not important, but the information they give is. The average Japanese farmer has to keep himself and his family on a very small income and he may even fall into debt.

2. Let us look at a Japanese farm. Your map shows a group of farmhouses. What town lies 20 miles to the west? (Osaka.) Where does the road east lead to? (Nagoya.) Distance? (80 miles.) See if you can locate the settlement on your atlas—it is too small to be marked. Which island is it in? (Honshu.) This is the central and largest island of Japan. You can add 'central Honshu' to your map title.

3. The farmhouse is one of a group—of how many houses? Count them—one plot, one house. (30 houses.) What do you think *buraku* means then? (Village.) Our farmer lives, like most Japanese farmers, in a village. What sort of land is the village on? (Upland.) Why is it

* Answers to the questions are indicated in brackets throughout to give continuity.

Table I
TYPICAL BUDGET OF A JAPANESE FARMER FOR ONE YEAR

<i>Income</i>	<i>Yen</i>	<i>Expenditure</i>	<i>Yen</i>
Rice crop	1004	Rent	504
Barley crop	64	Fertilizer and implements	208
All other sources	248	Taxes	30
	—	Food	345
Total	—	Clothing	52
		Repairs, light and fuel	44
		Wages for farm labour	43
		Miscellaneous	134
		Total	—

built on upland? (Gives well-drained site, other land used for rice.) Whereabouts in the village is our farmer's house? (On the outskirts.) How many fields has he? (8.) What do you notice about them? (Small and scattered.) Why is this a disadvantage? (Too small for machines, time wasted getting from one field to another.) How are they located? (4 on upland, 4 on paddy land.) Why do you think this is? (So that each farmer gets a fair share of both types of land.) [Word *paddy* may need explanation.]

4. Here is a description¹⁸ written by a man who visited this area.

Barley is cut in May; the fields are then dug to a depth of 18 inches, and flooded with water from an intricate irrigation system which turns them into soft mud. The mud is then strewn with manure and lime and worked over and over again until it is the consistency of slime, when it is carefully levelled, and flooded with running water to a depth of 2 or 3 inches. The best rice is sown where the water well covers the mud, and this necessitates much skill in arranging the irrigation channels so that a limited quantity of water may do duty for a large area.

The rice is sown broadcast in small beds in April. In June the young shoots are transplanted to the mudfields in rows, about a foot apart each way, some 4 or 5 shoots being pricked into each hole. This is very rapidly done, and at this season the rice fields are busy with men and women working nearly knee-deep in mud.

When the summer comes with its mounting heat, the sprouts spread out, and the whole field becomes vivid green; as the shoots grow higher the separating divisions of the field are lost to view, and a rice-grown valley seen from a short distance appears as smooth and even as if covered with velvet turf. The measure of heat given out by the summer sun regulates the harvest season. In an average year the crop is reaped in October, but after a cool and rainy summer it may be November before it is cut. Japanese rice is the finest the earth produces, as well it should be, seeing the extraordinary attention it gets. I have seen peasants carefully going over the crop with a lantern in the dead of night, and with a horsehair switch brushing away the insects. But rice is seldom eaten by the poorer classes. Barley and millet are their staff of life. The rice they produce is far too valuable for their own consumption, and much of it is exported. . . .

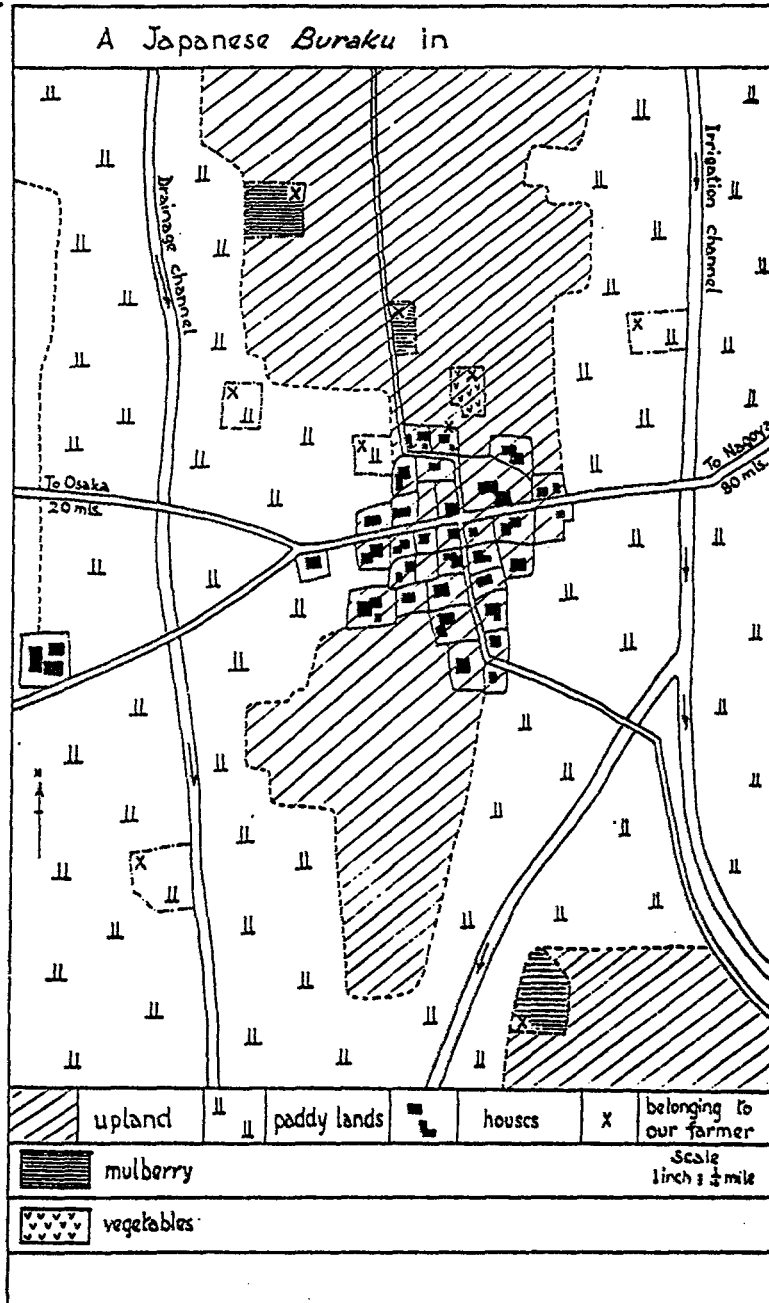


Fig. 2.—Duplicated map for class study. (After Trewartha, by kind permission of the University of Wisconsin Press.)

In late autumn, the roads through every rice district are hedged with sheaves of rice, and before every farmhouse the womenfolk are busy with the flails, hand-threshing. As soon as the last rice grain has been harvested from the fields they are prepared for barley. Barley is not sown in Japan as we sow it, broadcast or in drills, but in carefully tended, deeply worked, hilled-up rows or ridges, as we may grow potatoes. This winter grain is sown in clumps along the top of the ridges, for the Japanese believe it is less likely that way to be beaten down, whilst the winter rains drain off into troughs between the ridges, where the water may be 2 to 3 inches deep.

5. This tells us quite a lot about the two grain crops. They are? (Rice and barley.) When is barley planted? (October–November.) How? (By hand; on ridges.) Why? (No machines; on ridges for drainage.) This indicates that winter rains are quite substantial. When is barley harvested? (In May.) It is then a crop of which season? (Winter.) Planted where? (In rice fields.) Shade in on your map the area where barley is grown; and in the space given add a key which also gives months of planting and harvest.

6. If our farmer grows rice all through the summer, and barley as a winter crop, what will happen to his land? (Get worn out.) What does he do to make it continue to produce crops all the year round? (Fertilize.) He uses all the manure he can and also buys —? (Lime.) The other requirement of his land in summer is —? (Water for irrigation.) There is heavy rain in summer, but rice needs to grow in a depth of water. Where is the irrigation channel? (Running N–S across paddy fields.) There are also many ditches bordering all the small paddies which are not marked. Why is there also a drainage channel? (To take off water so that it does not get stagnant.) Our farmer, like all those in the buraku, pays water tax towards the upkeep of the irrigation and drainage canals. To pay this and for his fertilizer he sells —? (Rice, and in a good year, barley.) He then needs to buy —? (Other food.)

7. Let us look at our farmer's upland crops. Why do you think he grows vegetables? (To feed his family.) Then why do you think he uses that particular upland field? (Near to house.) If he has any surplus, he can sell in the nearest market town. How do you know the weather is warm enough for vegetables to grow all the year round? (If he can grow barley in winter, he can grow some vegetables too.) Add a note to the key about this, in the space after vegetables.

8. We are left with —? (Mulberry patches.) Why does our farmer grow mulberry bushes? (For silk worms.) [May need to tell class this.] Here is a short description of this work:¹⁹

The bush mulberry is planted at about two-foot intervals in rows spaced 3 to 4½ feet apart. It is cut off level with the ground each year, and the next year 6 to 12 shoots spring up, which reach heights of 4 to 6 feet. Silk-worms are reared from about the middle of April until the end of October. The worms are reared in farmhouses, all possible space being given over to the work. The mulberry leaves or sometimes whole branches of the bush

are put into the trays with the silkworms. After the worms have formed their cocoons the farmer carts his product to the cocoon market, where he receives cash for his crop.

What can we add about the mulberry to our key? (Pruned in winter; leaves for silkworm April–October.) Mulberry is a very useful crop for uplands—why? (Bushes will grow on rough ground; do not need irrigating.) Without it our farmer would have no silk cocoons to sell.

9. We can see that our farmer works very hard all the year round. How does he get money? (By selling grain.) [Refer to board.] In the case of our farmer “all other sources” would be —? (Silk cocoons and perhaps vegetables.) His expenses include —? (Food, fertilizer and water.) And some we haven’t mentioned? (Clothes, lighting, heating, repairs, and so on.) All the farmers in the buraku work in much the same way. Now write in your notebooks a few sentences about the following:—the fields, the chief summer crop and how it is grown, winter grain, the upland crops. Add your own title.

10. We have now found out a great deal about how farmers live in this particular buraku or village. There are thousands of buraku in Japan. In the north it is too cold for winter crops in paddy fields. Look at your atlas. Which island will not have winter crops? (Hokkaido.) The southern islands have a longer hot season and farmers can sometimes grow two crops of rice. Which islands are these? (Kyushu and Shikoku.) Which island is our village in? (Honshu.) In nearly all the villages there, people are living and working in this way.

[The annotated map may be fixed into the best book or file as part of the child’s work record.]

1.3 Environmental hazards

In earlier times people's lives were much more closely linked to their natural environment than they are today. This was especially true when most families used the land to produce their own food. Urbanisation has made many people much less directly dependent on their natural surroundings. In the United Kingdom, we may complain sometimes about the weather, but there are few other natural or environmental controls which directly worry us all that much.

Figure A Location of the Karakoram Mountains

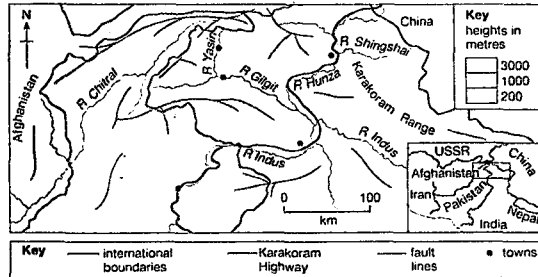


Figure B Natural hazards in order of priority as seen by the people of the Karakoram Mountains

Natural hazards	Impact on the local community	Ways to reduce or remove the risks	
		Possible solutions	Major difficulties
Failure of water supply	Loss or damage to crops and animals and farming land	Relocate settlements on better sites	High cost
Land erosion	Damage to buildings	Flood control measures (banks, ditches, dams) and warning systems	Lack of expertise
Flooding	Risk to health from drinking contaminated river water	Education	Few alternative sites
Earthquakes, which cause landslides and rockfalls	General hardship	New and safe construction methods	Social upheaval
Earthquakes	May result in abandonment of settlements		Unwillingness to move or change way of life and building methods
Earthquakes	Loss of human life		

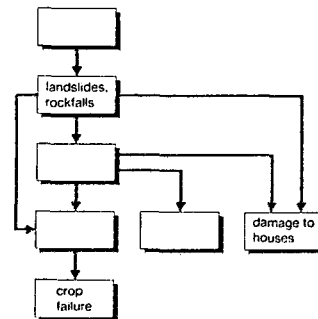
The Karakoram

In other parts of the world the environment is much more hazardous for people. The area in Figure A shows the Karakoram Mountains of Northern India and North-east Pakistan. Here people have to face a wide range of environmental hazards. The region is in one of the world's major earthquake belts (see page 13). Since 1900, over 1250000 people have died in earthquakes in the Karakoram. A single earthquake in 1976 killed 242000 people.

Earthquakes in the Karakoram bring with them other natural hazards. They cause landslides and rockfalls, which besides damaging villages and houses, can ruin cultivation terraces on the hillsides. By blocking river channels, landslides may cause widespread flooding and disrupt water supplies. Floods wash away valuable topsoil from the hillsides. Figure B summarises these hazards and their effects.

Deaths from earthquakes and other hazards in the Karakoram have been high partly because of the way local people build their houses (Figure D). Buildings have thick walls of stone and timber beams, and heavy timbers are used for the roofs. Because these walls have no proper framing or structure they easily collapse when they are shaken by an earth tremor.

Figure C Hazard flow diagram (see question 3)



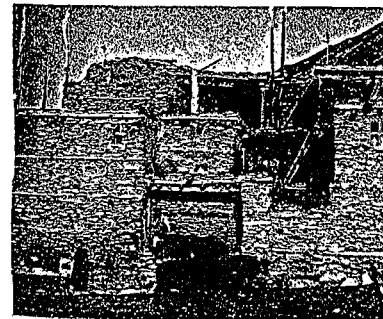
Living with hazards

A scientific survey team studied the area and found that the only way to remove the risks altogether would be to relocate villages. But there were few alternative sites. A move from hillside to valley would lessen the danger of landslides, but increase the risk of flash flooding. Villagers were not keen to move in any case. They did not want to leave their traditional homes, crops and livelihoods.

Figure B lists ways the survey team thought that the impact of hazards could be reduced. With all these solutions however there were problems of cost and technical knowledge. In the Karakoram there is little opportunity for villagers to receive the technical education they would need to build better quality houses or protective walls, or dig bigger river channels to take flood waters. In any case the costs are well beyond what they can afford, and they need all their time to grow the crops required for survival.

In the Karakoram, people are prepared to overlook the hazards of their natural surroundings so that they can deal with their everyday problems. Perhaps this explains why many people live in hazardous areas of the world despite the risks involved. On page 120

Figure D Buildings typical of the Karakoram area



you will read about Los Angeles, one of the world's largest and wealthiest cities. A major disaster is expected at any time, but people go on living there anyway.

Figure E Settlements overshadowed by the Karakoram range. People who live in this region care more about things like schooling, health care and their crops than they do about natural hazards

QUESTIONS

- With the help of an atlas:
 - Name *two* countries outside India and Pakistan which lie close to the Karakoram Mountains.
 - Name the larger range of mountains of which the Karakoram is a part.
 - What is the average height of mountains in the Karakoram?
 - Try to find some reasons why the Karakoram area is vulnerable to earthquakes (see pages 12-17).
- Describe how houses in the Karakoram are constructed.
 - Explain why such houses are often unable to withstand the shock of earthquakes or landslides.
- Copy and complete Figure C with the help of the list below:

earthquakes	failure of water supply
flooding	land and soil erosion
- Below is a list of some of the problems of living experienced by Karakoram people. Put the list in rank order of importance, as it might be ranked by a Karakoram villager. Justify the highest and lowest rankings on your list.

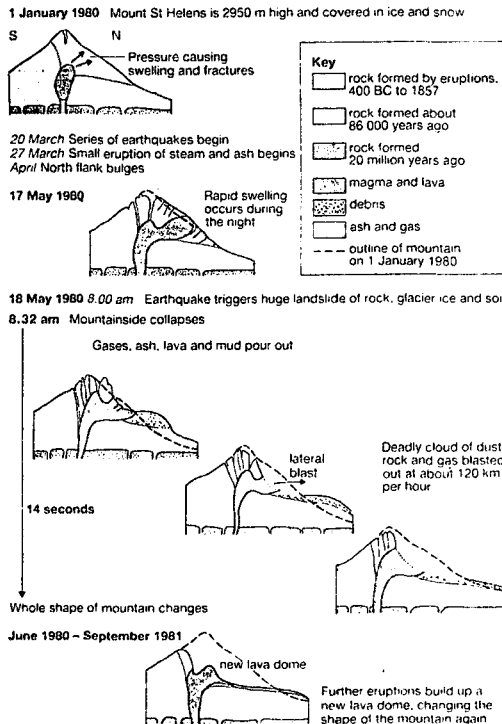
crop prices	lack of medicine	floods
no schools	rockfalls	crop failure
lack of firewood		
- What other problems could be added to the list in question 4?
- Write the section of the survey team's report headed **What is needed**. In it outline some proposals for schemes which might make life easier for Karakoram people. Justify your proposals, but also point out the problems they involve.

2.4 Mount St Helens 1: The eruption



Figure A (right) Mount St Helens erupting on 18 May 1980

Figure B (below) How the eruption happened



At 8.32 am on 18 May 1980 an earthquake triggered the collapse of the north side of Mount St Helens (Figure A), in the state of Washington, USA. Mount St Helens is a volcano which had not been *active* since 1857. Its eruption was the first volcanic event in the USA since 1917. Not surprisingly the eruption attracted a lot of public and scientific interest. Scientists had been predicting the eruption and were prepared to follow its progress second by second. Even so, the fury of the eruption took the scientists by surprise and several of them were killed.

How the eruption happened

Figure B shows the chain of events from 1 January to September 1981. Mount St Helens steamed and smoked, bulged and then blew up. In 14 seconds a deadly cloud of hot ash, dust, rocks and gas, travelling at 120 km per hour, destroyed huge areas of forest, wiped out wildlife, and killed 60 people. The shape of the mountain changed completely.

What caused the eruption?

Mount St Helens is one of many volcanic peaks in the Cascade Range of Washington and Oregon states. The peaks have been built up by a series of eruptions over the last 20 million years. On the map (Figure C) note how the small Juan de Fuca plate is moving away from the Pacific plate. The Juan de Fuca plate is being pushed under the North American plate and is forming a deep oceanic trench.

The Juan de Fuca plate is being pushed downwards at about 2 cm every year. As it descends it melts because of the high temperatures deep in the earth's crust. Here it forms molten rock or *magma* (see Figure B on page 12). This magma is less dense than the rocks surrounding it, and so it tends to rise

back towards the surface, a distance of about 100 km. It may become trapped just below solid surface rock where it forms magma reservoirs. The magma is often under pressure. Where earthquakes cause fractures in the surrounding rocks, through which pressure can be released, an eruption is almost certain to occur.

These conditions threaten the whole of the Cascade Range of mountains with eruptions triggered off by earthquakes.

Types of volcanoes

As Figure D shows, volcanoes are classified according to certain qualities. These are:

- shape
- how they are formed
- what they are made of

Some volcanoes are erupting all the time. The eruptions are gentle and at regular time intervals, like a hiccup releasing the pressure underneath. In other cases the pressure builds up over a long period, and when the volcano finally blows its top it does so with devastating effect. In the case of Mount St Helens the eruption had been predicted, and most people had been evacuated by the time it took place.

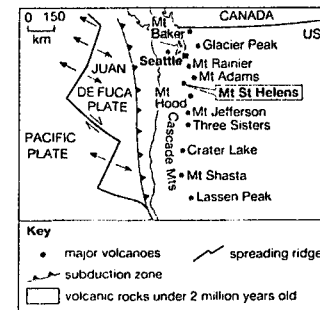


Figure C Location of Mount St Helens in the Cascade mountains

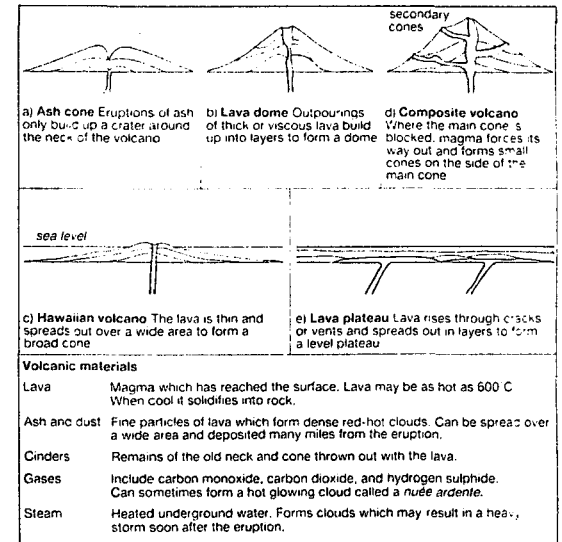


Figure D Composition and types of volcanoes

QUESTIONS

- Study Figure C:
 - In which range of mountains is Mount St Helens?
 - Name *three* other volcanic peaks which are within 200 km of this mountain.
- Produce a time-table for the eruption of Mount St Helens, using the following headings: *Date, Time, Event*.
- Name and describe *three* materials which the Mount St Helens eruption produced.
- Explain the role of the following in the Mount St Helens eruption:
 - plate movement
 - subduction
 - density of magma
 - earthquakes
 - fractures
- Do any of the types of volcanic forms listed in Figure D describe Mount St Helens?
- Will St Helens continue to build until it surpasses its former majesty, or will it blow itself apart in a new fury of destruction? (*National Geographic Magazine*, 1981)

Which possibility do you think seems the most likely to occur during the next few years? Justify your view.

2.5 Mount St Helens 2: After the eruption

The effects of 18 May 1980 were not limited to the scene of the eruption itself. The eruption changed the environment over a wide area (Figure A) and affected the lives of many people.

Rivers

When the mountain erupted, the sides of the volcano were still covered with ice and snow from the winter. The intense heat melted the ice and snow to release 200 000 million litres of water. The water turned the debris from the landslide into huge mudflows which poured into the river valleys and blocked them.

The North Toutle River was one of the worst hit. The valley floor was raised by up to 200 metres. With its natural channel clogged, the river

began to wander freely over the debris surface. It cut away embankments and began to form new meanders which threatened bridges, roads, and railways. At one vital bridge the American army spent 18 months digging away 100 million cubic metres of debris. By doing this they rechannelled the river and prevented further flooding.

Coldwater Lake, a reservoir in the catchment area of the North Toutle, became so full that it threatened to break its dam. To lower the lake to a safe level a new 1000 metre-long exit channel had to be dug during the weeks after the eruption.

Debris reduced the flow of the River Columbia so much that ships were trapped in the harbour at Portland. Intensive dredging was needed before the port could be reopened.

Wildlife and forests

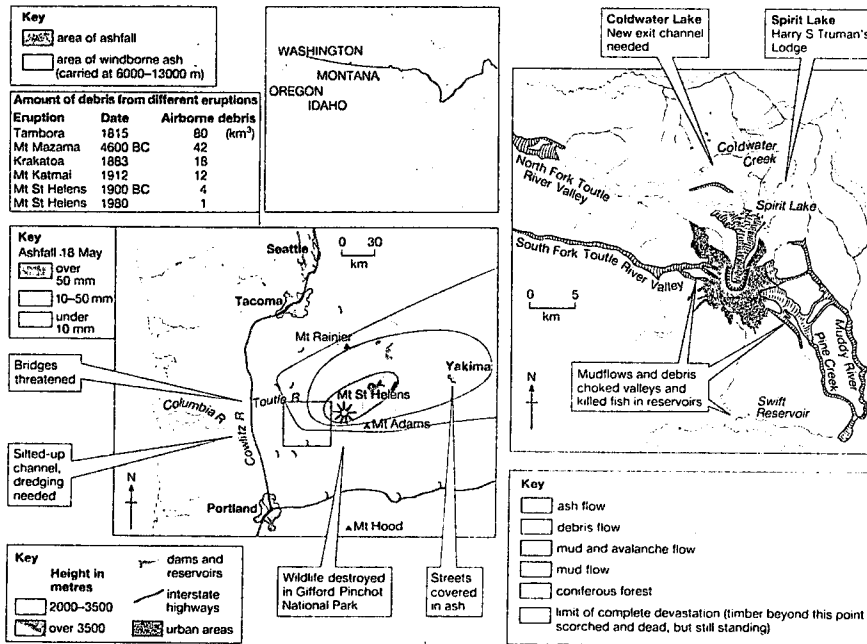
The hot mud pouring into rivers raised the temperature of the water to 30° C, killing most forms of water life and destroying fish eggs. Small creatures choked to death on the gas and ash. Hundreds of elk, bears, cougars, and mountain goats in the Gifford Pinchot National Park were destroyed. Altogether two million fish, birds, and animals perished in the explosion. Although some forms of insect life – such as flies and ants – began to revive quickly, scientists estimate that it may take forty years for the wildlife of the area to get back to normal.

The sides of Mount St Helens had been covered with pine, spruce, fir, and hemlock forests. The blast destroyed these forests, creating huge areas of scorched logs which rolled down the valley sides and blocked rivers. Timber companies managed to salvage some of this timber. It was estimated that ten million new seedlings will be needed to restore the area's forests.

timber industry. Fortunately, since the eruption had been expected, most people were evacuated from the danger area. Nevertheless sixty people were killed.

Throughout Washington, Montana, and Idaho transport was disrupted: cars stalled, electricity supplies were cut, and food supplies were threatened. Public access to the region was severely limited because of the fears of further eruptions.

Figure A The effects of the Mount St Helens eruption



QUESTIONS

1 Study Figure A:

a) Name *three* places affected by the eruption. In each case state how each place was affected.

b) Copy the main features of the right-hand map. On your copy draw a circle with a radius of 20 km with Mount St Helens in the middle. Colour it in. List the main effects of the eruption within this area.

2 a) Produce a checklist of as many effects as you can find in the text and pictures. Your list might start off like this:

- blocked valleys
- embankments cut
- bridges threatened

b) Now draw up a table with the three headings shown below and copy your list of effects into the appropriate columns.

Immediate effects (dealt with in a few days)	Short-term effects (dealt with over several months)	Long-term effects (dealt with only over several years)
---	--	---

c) Write a paragraph about how long the effects of the eruption lasted.

3 The viewpoints of four people about the eruption are shown below. Select *one* person's opinion and say how it compares with the other three.

"I need to get just one more sequence of pictures."

ROBERT LANDSBURG, photographer who never returned from the mountain

"I talk to the mountain, the mountain talks to me, I am part of that mountain, the mountain is part of me."

HARRY S. TRUMAN, elderly resident of the mountain, refused to leave and died during the eruption

"Yuck! Three feet of mud all over the place."

JOE HALLECK, schoolboy from Toutle

"It's been costing us 100,000 dollars a day. Yakima doesn't have the resources. The state and federal governments must help."

LARRY WITTENBERG, official of town of Yakima

The atmosphere

A huge cloud of ash was carried eastwards by prevailing winds. Most of it fell in Washington and western Montana where some places had 70 mm of ashfall. The ash cloud steadily widened as it drifted east and was seen over much of the United States (Figure A). Within 17 days it had circled the globe.

Scientists thought that the eruption might lead to colder climates by the dust absorbing incoming solar radiation. Although the eruption was spectacular it produced much less dust than some other recent volcanic eruptions. There was little effect on global climate.

People

Mount St Helens is a favourite area for camping, backpacking, and fishing. It also has various logging camps for the

APPENDIX 4A
DEFINITIONS FOR THE HIERARCHY OF PROCESS SKILLS
 (Adapted from Jones 1986:239)

- FACTUAL RECALL:** the pupil's ability to store information in his mind and to recall it later in substantially the same form. This may include knowledge of facts, terms, rules, procedures and theories.
- COMPREHENSION:** the pupil's ability to know an abstraction (a concept or a skill, for example) well enough to be able to demonstrate it correctly when specifically asked to do so. This includes the separate abilities to translate data from one form to another (e.g. to construct a climatic graph from temperature and rainfall figures), to interpret data and to predict trends from provided data.
- APPLICATION:** the pupil's ability, using accumulated knowledge and comprehension skills, to solve a new problem. Usually no mode of solution or procedure is specified.
- ANALYSIS:** the pupil's ability to study a statement (which in the case of Geography could be in the form of a map, diagram, graph or photograph as well as a prose passage) and separate it into its constituent parts, to distinguish between fact and opinion, between relevant and irrelevant and between cause and effect.
- SYNTHESIS:** the pupil's ability to build up separate elements into a connected whole and so produce a unique communication on a topic, as in an investigation leading to an individual study or project.
- EVALUATION:** the pupil's ability to make judgements about the value of various ways of solving problems or ways of tackling a problem.

APPENDIX 4 B
LIST OF SOUTH AFRICAN STD. 7 GEOGRAPHY TEXTBOOKS
USED IN THE EVALUATION

<u>AUTHOR</u>	<u>NAME OF BOOK</u>
1. Carr, D., <u>et al.</u>	<u>Successful Geography 7</u>
2. Delaney, B. & Graham, D.G.	<u>Travel your world 7</u>
3. Earle, J., <u>et al.</u>	<u>Window on the world 7</u>
4. Gear, D.S., <u>et al.</u>	<u>Shuters Geography 7</u>
5. Holmes, P., <u>et al.</u>	<u>Enjoy Geography Std. 7</u>
6. Magi, L.M., <u>et al.</u>	<u>New Geography in Action Std. 7</u>
7. Swanevelder, C.J., <u>et al.</u>	<u>Junior Geography 7</u>

APPENDIX 4C
TABLE OF THE 42 CASE STUDIES USED IN THE EVALUATION

<u>SOURCE</u>	<u>TOPIC</u>	<u>PAGES</u>
1. Earle, J. <u>et al.</u> , (1992) <u>Window on the world 7</u>	Armero mudflow	95
2. "	Mt. St. Helens earthquake	96-97
3. "	Worcester earthquake	102
4. "	1989 San Francisco earthquake	103
5. "	West Rand subsidence	106
6. "	Walvis Bay dune migration	115
7. "	Laingsburg flood	118-119
8. "	Northern Cape floods	119
9. "	Cyclone Domoina	123
10. "	Eastern Transvaal acid rain	134-135
11. "	Nelspruit river pollution	137
12. "	Tanker oil pollution	139
13. "	Chernobyl nuclear explosion	143
14. Carr, D., <u>et al.</u> , (1992) <u>Successful Geography 7</u>	1991 Bangladesh flood	126
15. "	U.S.A. tornadoes	131
16. "	Krakatoa volcano	132-133
17. "	Navado del Ruiz volcano	134-135
18. "	Armenian earthquake	136-137
19. "	1989 San Francisco earthquake	139
20. "	Cameroon lakes	140-141
21. "	1987 Natal floods	142-143
22. "	Kuwait war	156-157
23. "	South African soil erosion	158-159
24. Swanevelder, C.J., <u>et al.</u> , (1992) <u>Junior Geography 7</u>	1970 Bangladesh flood	158
25. "	Mt. Versuvius volcano	167-169
26. "	Mt. Pelee volcano	169-170
27. "	Mt. St. Helens volcano	171
28. "	Huang He River floods	186-187
29. "	Laingsburg flood	187-189
30. "	Quoin Point dune migration	200-201
31. "	Koeberg nuclear power station	211-212
32. "	Chernobyl nuclear explosion	212-213
33. "	Namibia/Peru overfishing	227-228
34. Gear, D.S., <u>et al.</u> , (1992) <u>Shuters Geography 7</u>	Mt. St. Helens volcano	105-109
35. "	San Francisco earthquakes	109-113; 115
36. "	1964 Alaska earthquake	109-115
37. "	Laingsburg flood	126-128
38. "	1987 Natal flood	126-129
39. "	River pollution fieldwork	143
40. Delaney, B., & Graham, D.G. (1992) <u>Travel your world 7</u>	Mt. St. Helens/ Mt. Versuvius volcanoes	40-42
41. "	1906 San Francisco earthquake	42-45
42. Holmes, P., <u>et al.</u> , (1992) <u>Enjoy Geography Std. 7</u>	Laingsburg flood	119-120

APPENDIX 4E
CONSTRUCTIVIST TEACHING STRATEGIES EVALUATION TABLE

TOPIC OF CASE STUDY:		SOURCE:	PP:	
CONSTRUCTIVIST TEACHING STRATEGIES			TICKS	NO.
INTRODUCTORY/EXPLORATORY ACTIVITIES	1	Brainstorming exercises		
	2	Debates and discussions		
	3	Role play		
	4	Simulations and games		
	5	Examining and reviewing evidence		
	6	Examining and reviewing options		
	7	Conducting experiments		
	8	Conducting fieldwork		
EXPLANATORY/SOLUTION ACTIVITIES	1	Providing and explaining ideas		
	2	Reviewing and evaluating ideas		
	3	Providing and explaining solutions		
	4	Reviewing and evaluating solutions		
	5	Predicting outcomes/consequences		
	6	Reaching group consensus		
	7	Model design and explanation		
	8	Scientific field research		
TAKING ACTION	1	"Framework fieldwork"		
	2	Writing reports and letters		
	3	Involvement in real-world/local issues		
TOTAL				

APPENDIX 5A
 LAINGSBURG FLOOD CASE STUDY
 SOURCE: SWANEVELDER ET AL., 1992: 197-189

Laingsburg flood (1981)

Another disastrous flood that struck South Africa was the Laingsburg flood of January 1981, when the Buffels River flooded the town Laingsburg and the area downstream, claiming the lives of 104 people.

Study fig. 6.2 (p. 188) and the photographs (p. 189) and consult an atlas to answer the following questions:

- (a) In which direction does the Buffels River flow?
 (b) In which mountain range does the Buffels River rise?
 (c) Name the main tributaries of the Buffels River.
 (d) What, according to fig. 6.2, was the rainfall at the various farms in the area during the period 23 to 25 January 1981? Calculate the average rainfall for the area in this period. Was it sufficient to produce a flood in its own right or was the flood associated with its distribution in the catchment area?

- (e) Consider the information in fig. 6.2 and the accompanying description and apply your own judgment in identifying all the factors that contributed to the cause of the flood.
 (f) Make a list of the possible damage that was caused. Do not forget about the farming community, urban services and communication and transport facilities. Use the photographs on p. 189 and your atlas.
 (g) Draw a pencil line connecting all the points of origin of the tributaries. What is the approximate shape of the line?

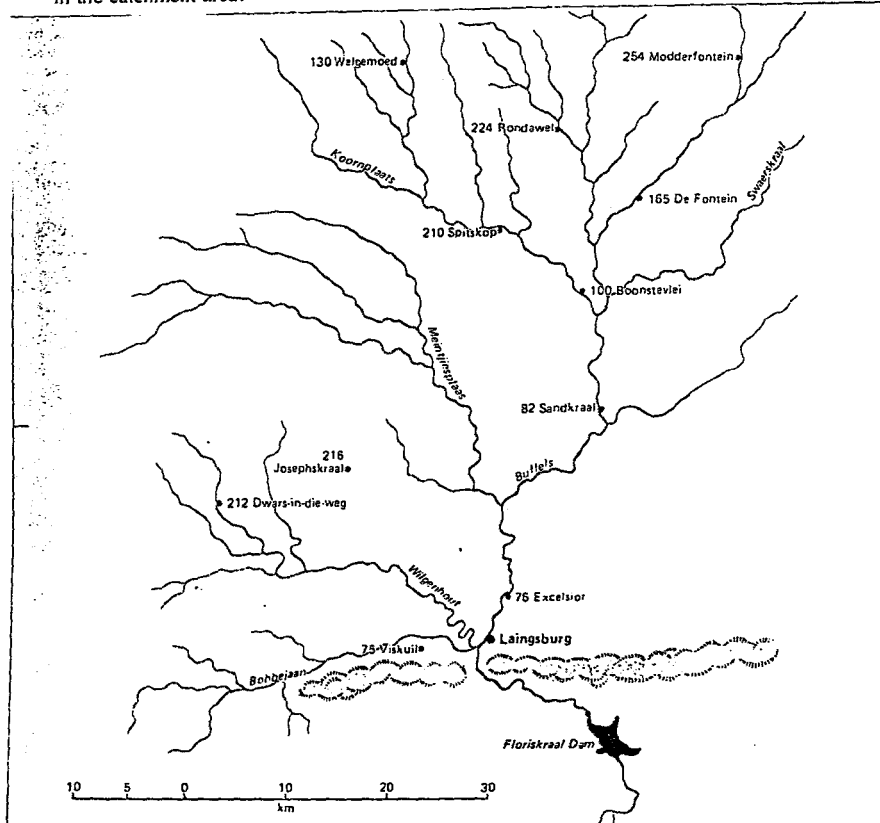
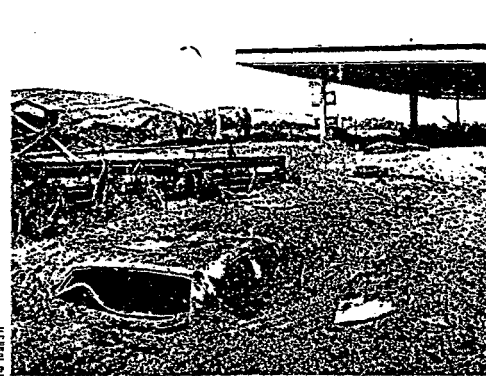


Fig. 6.2 Catchment area of the Buffels River with its tributaries. The rainfall (in millimetres) was measured on farms for the three days 23 to 25 January 1981. Notice the confluence of the streams at Laingsburg and the narrow gap through which the river passes at that point. Most drainage systems are pear shaped so that water from precipitation over the entire catchment area does not reach the point of confluence at the same time. The drainage system of the Buffels River is more semicircular in shape. Run-off from all the tributaries therefore reaches the point of confluence (Laingsburg) at the same time. That is why Laingsburg is prone to floods, even from moderate rainfall over the entire catchment area.



Two photographs clearly showing the results of the Laingsburg flood of January 1981. The one shows how the houses were washed away - only the foundations remained. The other shows how sludge, several metres thick, has been deposited, as at this garage in the main street. Over a hundred lives were lost.

APPENDIX 5B
SAN FRANCISCO EARTHQUAKES CASE STUDY
SOURCE: GEAR, ET AL. 1992: 109-113; 115

8.3 ALASKA 1964 — THE STORY OF AN EARTHQUAKE

KEY IDEAS

- The only real protection against earthquakes is to avoid living in an earthquake zone.
- Strict building standards offer considerable protection from the side effects of an earthquake.
- The actual ground movement in a major earthquake is not all that great a danger in itself. The real danger is rather the effect on buildings and other human-made facilities.

KEY WORDS

block glide
 epicentre
 harbour wave
 landslides
 secondary damage
 seismic
 tsunami

Investigations

1. Consider the damage done by an earthquake:
 - List the types of secondary damage done by the earthquake.
 - For each, suggest a way that secondary damage could be limited.
 - Had the citizens of Anchorage had 24 hours warning of the earthquake, what action could they have taken to save lives?
 - If they had had one month's warning, how do you think they would have reacted? Bear in mind that they would only be warned that a large earthquake *may* occur and that there would still be no way of knowing precisely when and where.
2. San Francisco is likely to be the site of a major earthquake in the next 50 years. Do some library research on San Francisco and then imagine that you are an eye-witness reporter to a major earthquake which severely damages the city. Write a report on what you saw from a vantage point as the earthquake struck. Study Figure 8.3.5 and the newspaper cuttings (Figure 8.3.2) of the 1989 San Francisco earthquake.



Figure 8.3.1 Houses on steep slopes just north of Golden Gate in Mill Valley (see position on the map on page 113)

The human side of earthquakes

Figure 8.3.3 shows the position of Anchorage on the southern coast of Alaska. The earthquake struck at 5.36 pm on 26 March

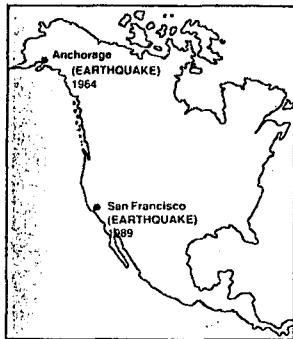


Figure 8.3.3 Recent earthquakes in the USA

1964. The following are some of the human stories that arose from this disaster. Like St. Helens, this event did not kill all that many people, but it was studied in great detail.

Extracts from *Earthquake* in the *Planet Earth* series published by Time-Life books:

Along the entire south-central coast of Alaska, the earth shrugged like some monstrous animal turning in its sleep. The convulsion shuddered along the Alaskan land-mass with awesome speed and force, cutting an 800 kilometre swathe of destruction from the fishing port of Cordova in the east to Kodiak Island in the west. Rockslides and avalanches crashed down the sides of mountains, roadways collapsed, bridges crumbled, entire towns were ravaged.

In Penney's department store, mirrors and display cases exploded into shards of glass, chunks of ceiling plaster shook loose and fell. Then the lights went out. Carol Tucker found a stalled escalator and blundered down it. Somehow she got down the next flight to ground level. Just before going out the front entrance she paused. At that moment the building's facade, massive concrete panels 12 cm thick, began to break off the structure and cascade into the street. A young man crouching on the sidewalk was crushed to death. A woman driving by was struck and killed in her car.

A new six storey apartment house — mercifully unoccupied — collapsed in a heap. A crevasse opened up beneath the Government Hill elementary school, tearing the structure down as one wing dropped 6 m into the depression. A 400 m section of 4th Avenue ripped apart; bars, stores, pawnshops, and cars along one side dropped three metres in a splintered tangle of devastation — by some geological freak leaving the other side intact.

*In north-west Anchorage a 30 block area slid horizontally in what geologists call a **block glide**. Structures at the edges were shattered, but those near its centre survived.*

In addition, the shaking destroyed road and rail links, but perhaps the worst was still to come. The heaving of the land and landslides cascading into the sea generated giant harbour waves at Valdez, 200 km east of Anchorage. A freighter, the *Chena*, was lifted onto the dock, crushing workers on the quayside. The shoreline collapsed, causing harbour waves to surge back and forth. A lighthouse, 11 m above sea level, was broken off by the waves.

At Seward, 120 km south of Anchorage, an oil tanker was busy loading when the earthquake struck. The oil lines parted, spewing oil over the water and the quayside. Huge storage tanks on shore split open and there was soon a wall of fire across the whole of the seafront. Harbour waves surged across the pier, not dousing the flames but spreading them. The harbour waves soon abated, but another terror was soon to make itself felt.

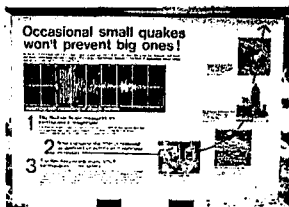


Figure 8.3.4 An earthquake warning

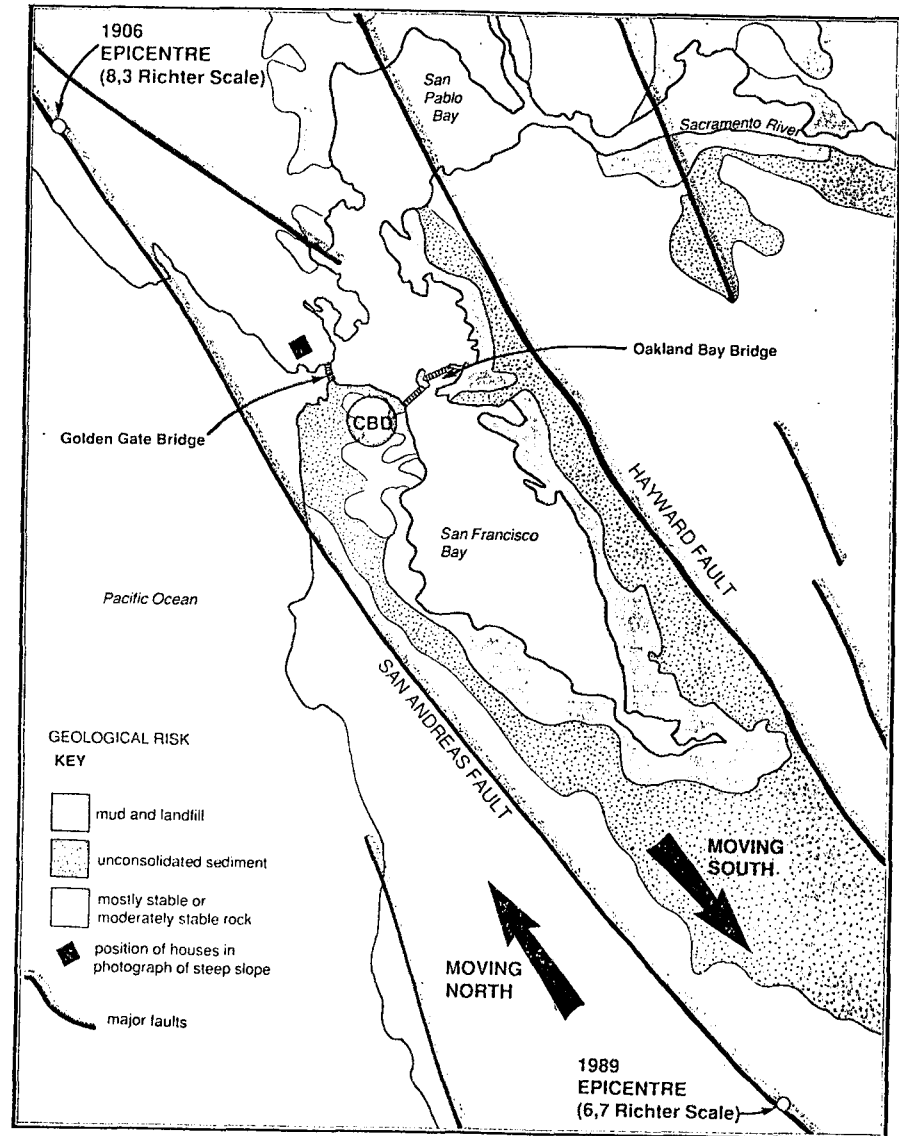


Figure 8.3.5 San Francisco case-study

● 250 known dead, toll may rise ● Motorists crushed, many fires

San Francisco quake disaster

Looting, vandalism in cocaine-dealing area

A powerful earthquake struck San Francisco at the height of the evening rush hour yesterday, killing at least 250 people and injuring more than 500, officials said.

The earthquake ripped out parts of roads and a packed Bay Bridge, crushing motorists. Rescue workers struggled to free people from trapped buildings while fires roared in the fashionable Marina area near the Golden Gate Bridge and other parts of the hilly tourist city.

California officials estimated the damage at \$1 billion.

The earthquake, measuring 6.9 on the Richter scale, strong enough to cause very heavy damage, rolled through the San Francisco Bay area when thousands of people were in lifts or heading home in cars, buses and trains.

Two hundred people were killed when 1.6 km of the two-tier Nimitz Highway, leading off the busy Bay Bridge, collapsed on to the road below, crushing motorists in a "concrete sandwich". Four hundred people were injured in the crush.

A 15 m section of the bridge

also collapsed. Motorists hung on to the crumbling masonry by their fingertips until they fell on the roadway and into the water below.

Skyscrapers swayed by as much as 2 m, trapping people in lifts.

The city's police chief, Mr Fred Jordan, said he had reports from his commanders of incidents of looting and vandalism in Third Street, the city's major crack and cocaine dealing area.

Co-operation and innovation among thousands of workers stranded in darkened city

Residents' pitch-black night of fear

SAN FRANCISCO—Thousands of stranded office workers mingled with the homeless in San Francisco's darkened streets as a pitch-dark night, a night of fear, fell over the quake-damaged city.

Fire engines and ambulances, sirens howling, picked their way through the darkness and over glass-strewn streets as a few stars peeked through a layer of smoke from a fire raging in the Marina district.

And desperate people lined up 20 deep at pay telephones to call home.

"Answer, darnit!" Jeff Darling yelled into one phone as he tried to reach his wife and child across San Francisco Bay in Berkeley after the earthquake.

When the phone went unanswered, Darling dropped the receiver and sobbed uncontrollably. "I've got to know, I've got to know. What happened?" He said his house was undergoing renovation and he feared that some of the supports may have been undermined by the quake.

But on other streets, the scene seemed festive. Some fireworks

were set off, and children played outside.

Tempers flared occasionally at the lines for telephones. At one, a shoving match broke out between a man in line and a man on the phone. The two were pulled apart and the people in line agreed to talk no more than three minutes each. — Sapa-AP.

The Gran on the San Andreas fault

WATSONVILLE — A few miles south of the Santa Cruz Mountains, epicentre of the latest earthquake to strike California, the walls of Vivienne Dutro's house groaned and cups rattled from the nearby San Andreas fault.

But the 87-year-old woman, who survived the even more powerful San Francisco

earthquake of 1906, was unperturbed by the drama, even, perversely, a little pleased.

Apart from her concern for the dead and injured, Mrs Dutro thought the quake would turn out to be good for California.

"A lot of newcomers will get nervous and move out of the state, which we are happy for," she said.

"It's getting too crowded here for our liking."

Mrs Dutro and her husband Walter (85) have lived within a few kilometres of the San Andreas fault all their lives and, like many native Californians, have no fear of earthquakes.

Dazed city gropes back to reality

San Francisco fights to face up to horror

SAN FRANCISCO — As the aftershocks roll in their hundreds through a shattered city, San Francisco seems mired in confusion.

Even now, days after, it is hard to grasp the horror of the devastation.

My electricity's still out. There is no TV, although some newspapers are still being delivered.

As I clear the rubble out of my kitchen, I realize that I could have been seriously injured had I been there when the ceiling fell.

Food rots in my refrigerator in the hot Indian summer. The candles are running out.

We have had 1 400 aftershocks. More people have been evacuated in the hard-hit Marina district. I jump even at the sound of a door closing.

Fatigue is setting in as the immediate shock passes. Many people I talk to seem strangely slow and unfocused. Their speech is slurred. We are groping for something.

And some officials say the double-decker freeway that collapsed — killing more than 250 — is beyond repair.

We know, too, that bodies, but no survivors, are being extracted from crushed cars. And we survivors all remember how

often we have driven on that murderous freeway.

On the radio, I hear of hysterical residents in the Marina district pleading with those demolishing their homes.

But they are not allowed to retrieve their belongings before the bulldozers move in.

Yesterday the mood was bizarre. People barbecued in the streets. Deck chairs were lined up on the sidewalk.

The future looks grim.

Disaster is no surprise

Taking chances in city of beauty

San Francisco, one of America's most beautiful cities with its elegant seascape and temperate climate, is also one of the deadliest with the unstable San Andreas fault running alongside it.

SAN FRANCISCO — The San Andreas fault is the greatest fracture anywhere in the earth's crust. Severe quakes have hit San Francisco as far back as 1869 and one in 1906 almost doomed the city.

Those who live in the city's

splendour know they are taking their chances and it was no surprise when disaster hit again yesterday. The quake which hit the city was more than 30 times greater than that which hit the Bay area in June 1988.

Figure 8.3.2 (this page and opposite) Some newspaper cuttings about earthquakes caused by the San Andreas fault in San Francisco

BEFORE DISASTER STRIKES

LEARN YOUR SURVIVAL SKILLS

PREPARE A FAMILY PLAN

- Know how to contact each other in an emergency
- Know where to go to get help
- Know the likely activities of all family members

PREPARE A SURVIVAL KIT

- Water in plastic containers
- A first aid kit
- A torch with spare batteries and a spare bulb
- A transistor radio and spare batteries
- Canned food and an opener

CHECK AND STRENGTHEN STRUCTURES AROUND YOUR HOME

- Foundations
- Chimney
- Hot water cylinder
- Heaters
- Heavy furniture

LEARN SOME PRACTICAL SURVIVAL SKILLS

LEARN HOW TO:

- Turn off the electricity, gas and water at the mains
- Collect and save water
- Prepare hot food without electricity or gas
- Build temporary hygienic toilet facilities
- Give someone first aid

WHEN DISASTER STRIKES

IF YOU HEAR THE CIVIL DEFENCE WARNING SIGNAL - turn on your radio and wait for instructions

DURING A STRONG EARTHQUAKE

- Keep calm • Stay indoors • Take cover in a doorway or by a strong structure
- Keep away from windows, heavy furniture and structures that might move

WHEN THE SHAKING STOPS

- Check yourself and others around you for injuries - give first aid
- Put out small fires
- Turn off power, gas and water at the mains
- Be aware of aftershocks - they can destroy already weakened structures

IN A RISING FLOOD

- Listen to the radio for instructions
- Check your survival kit - is it ready for a quick get away?
- Put valuable possessions above possible flood water levels
- Poisonous substances should also be placed above flood water levels

WHEN A STORM THREATENS

- Fix loose boards and roofing iron
- Put rubbish bins where they cannot be blown about
- Place tape across large windows
- Stay indoors during the storm
- Shelter in the strongest part of the house
- If the roof starts to lift - open windows on the sheltered side of the house
- Listen to the radio for information

DURING A VOLCANIC ERUPTION

- Stay indoors • Close doors and windows
- Check your survival kit - do you have enough drinking water saved?
- If you have to go outside - cover your eyes, nose and mouth
- Keep clothes you wear outside separate from clothes worn inside

WHEN A TSUNAMI WARNING IS ISSUED IN YOUR AREA

- If you are near the coast - move to high ground or go at least 500 metres inland
- Keep away from rivers and estuaries - tsunamis can travel along these at great speed
- Never go to the beach to watch a tsunami come in - if you see the waves it will be too late to escape

IN ANY DISASTER - DO NOT GO SIGHTSEEING - DON'T FORGET YOUR PETS - THEY NEED CARING FOR AS WELL!

IN AN EMERGENCY YOU MAY BE FORCED TO LEAVE YOUR HOME
If you evacuate your home - make sure nobody is left behind! Take valuable papers and special medicines with you. When you leave your home - tear off this page and post it in the letter box so it can be seen from the road. This will save the rescuers time. Time can mean lives.

IF YOU LIVE IN AN ISOLATED AREA AND NEED HELP - HANG A LARGE SHEET OUTSIDE TO ATTRACT ATTENTION

FILL THIS IN IF YOU LEAVE YOUR HOME

WE LEFT AT _____ am/pm WE HAVE GONE TO _____

THE ADDRESS IS _____

Figure 8.3.6 Extracts from a New Zealand phone book. These articles are published by the New Zealand Civil Defence Association to help people prepare for disasters

The shaking earth generated giant sea waves or tsunamis, which are sometimes incorrectly called tidal waves. These not only surged into the narrow bays of the Alaskan coast, but spread out across the Pacific Ocean, travelling at 600 km per hour. A family of four was drowned as they camped out on a beach on the coast of Oregon, thousands of kilometres from the epicentre. Ten people were drowned in northern California and the waves were observed in Japan some 6 000 km from the epicentre, although they had lost their fury over that distance.

The earth continued to vibrate to after-shocks for 18 months after the initial shock. Billions of dollars worth of damage was done, but, due to the low population density, only 115 people were killed.

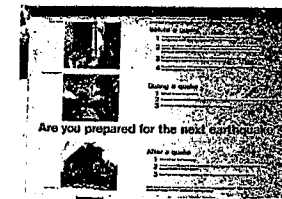


Figure 8.3.7 Another earthquake warning

Earthquakes around the world

Earthquakes and volcanoes occur mainly along the edges of tectonic plates, but there is no place on earth that is completely free of seismic activity. Energy from folding and faulting of the crust can be stored in the rock, only to be released as an earthquake millions of years later. The largest earthquake recorded in South Africa occurred in the old fold mountains of the south west Cape in 1969, destroying many buildings in the area around Paarl and Tulbagh. Other quakes have caused minor damage in southern Natal and the north eastern Cape in recent years.

CLASS DISCUSSION

According to you, why do people live in areas that are subject to frequent earthquakes, such as San Francisco? Would you live in such a place? Would your answer be different if you had been born in San Francisco?

SUMMARY OF ENDOGENOUS HAZARDS

	Results	Precautions/Prevention
1. Seismic hazards (earthquakes)		
1.1 Shaking ground	Damage to buildings, bridges, etc.	Better building standards
1.2 Landslides	Roads and rivers blocked	Avoid building above unstable ground (very difficult to avoid)
1.3 Block slides	Land slides sideways over slippery clay layer	Avoid building on clay
1.4 Fire	Gas, oil and electricity lines broken, causing fire	Turn off gas, oil and power supplies during a tremor
1.5 Disease	Clean water supply disrupted by earthquake. People drink dirty water	Keep a few days' supply of drinking water and water-purifying tablets
2. Volcanic hazards		
2.1 Nuée ardente and Ignimbrites	Fast-moving clouds of hot ash and gas	Obey official warnings to evacuate
2.2 Lahars	Fast-moving hot mud flows	Obey official warnings to evacuate. Move to high ground
2.3 Ash fall	Slow building up of ash on top of buildings	Wear masks. Sweep ash off roof to prevent collapse. Give up and leave
2.4 Lava flows	Lava flows down slopes of mountain	Obey official warnings to evacuate
2.5 Climatic change	Increased rain/decreased rain	Not possible to predict what changes will take place, therefore not possible to take precautions

Case Study: Mount St Helens

Close studies of Mount St Helens began in 1969 by a team from the University of Washington in Seattle. In 1972 they established a permanent observation station, and in 1977 the USA Congress gave funds for sophisticated seismic monitoring instruments. Thus, by 1980 Mount St Helens was closely watched, with more than 50 stations.

Countdown to disaster 1980

20 March First strong quake measuring 4.2.
 22 March Quake of 4.0.
 25 March Continuing minor quakes forced Forest Service to close the area to the public. By evening there were three quakes per hour of 4.0 or more.

27 March Explosion on north side of peak (steam eruption).
 Mid-April Large bulge near top of old cone observed.
 12 May Bulge grown by 150 m. Quake of 5.0.
 18 May 08:32: Quake of 5.1, crater explodes. (See Fig. 3.17.) Mount St Helens erupts.

The eruption caused damage in two main ways. As the bulge broke loose it was hurled down the north side of the mountain. The rock in the bulge, surrounded by water and very high temperatures for so many days, had been turned into clay. Some 3 billion m³ of mud, ash, rock and ice dropped into the upper waters of the Toutle River, forming deposits as thick as 180 m. The heat of this avalanche melted snow

and ice on the flanks of the mountain, and this mixed with the debris to form a huge mudflow which travelled nearly 50 km down the river. (See Fig. 3.17.)

At the same time the removal of all the mass of the bulge caused the pressurised, superheated water in the magma to flash to steam in a tremendous lateral explosion. The enormous force of this lateral blast knocked down timber (even trees as tall as 60 m and 5 m in diameter) over an area of more than 650 km². The cloud of steam and ash (at temperatures of about 250 °C) raced along at speeds over 300 km/h. The destruction, for more than 20 km in some directions, was total.

The eruption was not an isolated event. Geologists have established that the mountain has been active for about 40 000 years! The local North American Indians knew it was volcanic and it had erupted in 1832 and 1857. But by the 1980s the whole area had been so quiet that most people were unaware that it was in fact an active volcano.

Case study: Mount Vesuvius

Mount Vesuvius in Italy is a child among volcanoes, only 17 000 years old and 1 300 m above sea level, but it is one of the foremost volcanoes on earth. It has been intimately involved with mankind for at least 3 000 years and is surrounded by the largest population - more than two million people - ever to live in the immediate vicinity of an active crater. It is only in recent history that much attention has been paid to it - the ancient Greeks and Romans paid more attention to Etna, to Vulcano and to Stromboli. The Greeks enjoyed Vesuvius because it overlooked fertile soil, forests, beautiful bays and safe anchorage. By the time of the Romans the area was already populated with prosperous farmers, merchants, public administrators and holiday-makers. The towns of Herculaneum and Pompeii had been established and were flourishing. In AD 62 the first sign of danger came when a violent earthquake caused serious damage in both places. During the next seventeen years new temples, bath-houses, houses, taverns and theatres were built to replace those destroyed in the earthquake.

When tremors began in mid-August of the year 79, no one understood that Vesuvius was warning of an eruption. A violent quake caused damage on 24 August and the summit of the mountain split open. A fiery cloud burst out with incredible speed, spewing out ash and steam. Pompeians were showered with stones and pumice, and then fine ash. Herculaneum, 14 km to the northwest, suffered even worse as a river of mud engulfed the town.

When the eruption was over Herculaneum and Pompeii had been buried to a depth of 15 m, and Vesuvius had blown away much of the western side of the old crater. Both towns, with their buried dead, were officially abandoned.

By 1037 Vesuvius had erupted many more times. Then it fell dormant for nearly 600 years. By this time lush forests once again covered its slopes and cattle grazed on the plain. No one was ready for the devastation of 1631. During summer quakes began which grew in intensity and by December the crater was filled with water. The eruption began on 16 December with a series of explosions of ash and steam. Just before noon on the 17th, two fissures opened in the southwestern side and floods of lava poured out. That evening rivers of mud and new lava flowed out of the south side. When the eruptions ceased on the 18th, more than 4 000 people had died, and Naples was knee-deep in ash.

Vesuvius spoke up again with a series of nine violent eruptions between 1766 and 1794. By 1845 a permanent observatory had been built high on the mountain. It was from here that the next eruption, in 1872, was directly observed. The Italian physicist, Luigi Palmieri, made history by staying in observation for the whole eruption! After this the mountain was quiet long enough for a rail line to be built to the 750 m level, and a hoist to the top. Many thousands took advantage to see the crater at first hand. This was blown away by yet another eruption in 1906. Once again scientists stayed in the observatory during the eruptions. Once they had to rescue sightseers engulfed by gas and ash! It was the worst eruption since 1631. The mountain had lost 320 m from the crater rim.

In the years since Vesuvius has erupted only once, in 1944. The ground is again green and cultivated, and new generations of tourists gape at the mountain and wonder: when again?

Other volcanoes

The volcanic island of *Hawaii* is about 800 000 years old, but to the northwest the islands are even older, and all were formed volcanically. Far beneath the crust is a magmatic 'hot spot' over which the crust is slowly moving. As it moves eruptions produce volcanic islands with craters such as Kilauea and Mauna Loa. The Hawaiian eruptions are of the 'quiet' type. Lava is over 2 000 °C and runs like water. There is some gas which causes spectacular fountains of lava up to 500 m high. Lava fills the crater during an eruption and then spills over to run down the flanks. This very hot lava cools

to form a smooth rock known as pahoehoe (pronounced pa-hoy-hoy). Cool, blocky, sticky lava is known as aa! In the early 1980s, Kilauea erupted over a period of several years, some lava flows even reaching the sea.

The area around *Iceland* is also volcanic as it lies on plate boundaries, in this case along the Atlantic mid-oceanic ridge. In 1963 two eruptions produced new islands. One volcano produced only ash and pumice and the action of waves quickly eroded it away. The other was coated with lava and was able to survive. It is called Surtsey.

Neither of these eruptions were particularly hazardous, however, but others were. In North Island, New Zealand, in December 1953 the crater of Ruapehu was filled with boiling water. Interaction with minerals dissolved out acids which softened the crater walls. On Christmas Eve eruptions broke the crater wall and a seething mass of boiling acid and mud (called a *lahar*) rushed down the mountain-side. It easily swept aside a rail bridge and an express train plunged into the maelstrom, killing 151 people.

In Columbia in 1985 the Nevado del Ruiz, which had not erupted for 400 years, erupted during a violent earthquake. Melting ice and mud flowed down either side of the volcano and one such flow engulfed the town of Armero 50 km away. 20 000 of the 23 000 inhabitants died.

In August 1986 in the Cameroon (central Africa) Lake Nyos produced a carbon monoxide gas flow which killed more than 1 700. Although there was no eruption in the classical volcanic sense, the event was volcanic in origin. Lake Nyos lies on the Cameroon line, a volcanic chain stretching inland from the Bight of Biafra through the Adamawa Highlands.

Teach yourself

Use the following exercises to make notes on 'Volcanoes', and to improve your knowledge of this exciting field.

1. How many active volcanoes are there and what are their main causes?
2. Is it easy to classify volcanoes? What are the simplest ways?
3. Summarise the important events of either Mount St Helens or Mount Vesuvius.
4. What are the main effects of volcanic action?
5. Use books from your school or local libraries to find out more about volcanoes. Here is a list:
Earthshock: Basil Booth and Frank Filch, J M Dent, London, 1979.

Fig 3.17
 Source: Gary Rosenquist / Earth Images

Bulge: For more than a month before the 1980 eruption pressure of the magma chamber caused the north face of the mountain to bulge upward and outward. At 08:32 on 18 May an earthquake broke the unstable bulge loose, starting the landslide under way in the photograph.



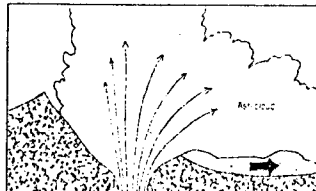
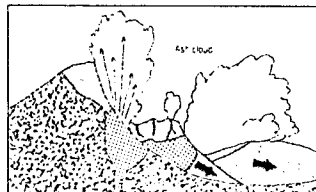
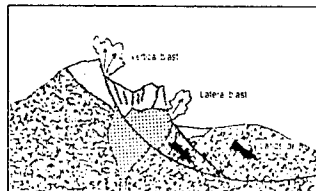
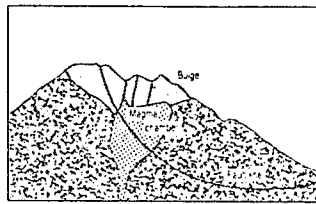
Landslide: Huge quantities of rock and ice slide down the north face of the volcano. Superheated water in the rock flashed to steam and exploded laterally from a fissure midway down the slope then upward from the summit. The photo taken five seconds after the first, shows the emerging plumes of steam and pulverised rock.



Blast: Fifteen seconds after the first photograph was taken the landslide and steam explosions uncover the magma chamber. Its power redoubled, the explosive release of steam jets upward from the collapsing summit, while the magma itself blasts a high-velocity cloud of superheated debris horizontally from the shattered north face.



Surge: Clouds of ash and debris obscure the entire north face of the volcano just 25 seconds into the sequence of photographs.



PART 4

Earthquakes

We have learnt that earthquakes are caused by the movement of continental and oceanic plates. The pressure on each side of the plate margins is very high, so when they snap loose and move, enormous amounts of energy are released in the form of earthquake waves.

The point underground where the earthquake occurs is called the focus.

The point on the surface immediately above the focus is called the epicentre.

In 1988 in the Soviet Union, continental plates below Armenia shifted vertically. How did this earthquake affect people's lives?

Armenia, Soviet Union, December 1988

At 11:41 am on 1 December 1988, all the children at Elementary School no. 9 in Gorky Street, Leninakan in Armenia, were in their classes. 20 km underground, two huge pieces of the earth's crust shifted slightly. The shock waves generated by the movement flattened all the buildings higher than one storey within a 40 km radius. The school buildings collapsed. Falling walls and roofs killed 50 children and injured hundreds. Leninakan was reduced from a busy city with a population of 290 000 to a heap of rubble filled with dead and dying people. The nearby town of Spitak, with a population of 30 000, was completely flattened. Fires were caused by broken gas pipes and electricity lines and these destroyed the remaining buildings. Half a million people found themselves homeless in bitterly cold winter weather, with no clothes or food. Zhena Suakyan was one of those buried alive and rescued. She survived because her son recognized a ring on her finger — the only part of her body that was visible in a pile of rubble.

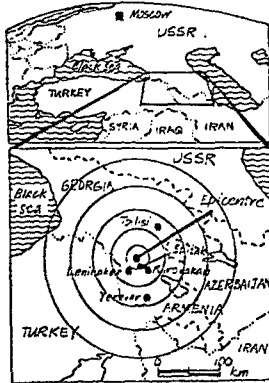


Figure 4.23 Earthquake waves in Armenia.



PART 4

NATURAL DISASTERS

QUESTIONS

1. Why do you think that more people died in Armenia than in Mexico City?
2. Where was the epicentre of the Armenian earthquake?
3. Could people have been responsible for making the effects of the earthquake so bad?

Falling buildings killed many people. Modern buildings in the Soviet Union are built shoddily to save money. Most people live in nine-storey apartment blocks which are made of precast concrete slabs held together by metal hooks. The walls and roofs of many apartment buildings collapsed under the strain of the earthquake waves. The size and weight of the slabs made rescue efforts very difficult. Offers of help came from all over the world. Both rich and poor countries contributed to rescue and relief efforts.

The earthquake registered 6.9 on the Richter scale. It was considerably smaller than the shock waves experienced by Mexico City in 1985 which measured 8.1, but the death toll was much worse. 45 000 people died in Armenia, compared to 10 000 people in Mexico City.

Earthquake Top Ten

DEATHS	PLACE	MAGNITUDE (RICHTER SCALE)	DATE
242 000	China	7.8 - 8.2	July 28, 1976
200 000	China	8.3	May 22, 1927
110 000	USSR	7.3	Oct 5, 1948
100 000	China	8.6	Dec 16, 1920
100 000	Japan	8.3	Sept 1, 1923
63 000	Italy	7.5	Dec 28, 1908
70 000	China	7.6	Dec 26, 1932
66 794	Peru	7.7	May 31, 1970
30 000	Turkey	7.9	Dec 26, 1939
30 000	India	7.5	May 31, 1935

Figure 4.24 Earthquake Top Ten.

QUESTIONS

1. Look at the map of the continental plates on page 24. Copy this map into your notebook.
2. Now look at the Earthquake Top Ten. Plot the location of the earthquakes mentioned in the chart onto your map. How close is the relationship between the earthquakes and the edges of the plates?



Did you know?
Over a million earthquakes happen every year. Most of them are so small that no one notices them.
One of the worst earthquakes in history happened in China in 1556. Over 800 000 people were killed.

Unit 10

Disappearing soil – a case study of Lesotho

Throughout the world topsoil is being removed at an alarming rate. Some estimates predict that the amount of topsoil per person will be reduced by over 30 per cent by the year 2000. Topsoil is of vital importance in farming as it is rich in rotted organic matter, called humus, and contains most of the nutrients essential to plant growth. The loss of topsoil threatens crop yields, especially in the less developed world. Losses can be made up by adding organic matter and chemical fertilisers to the soil, which is normal practice in the more developed world. However, this can result in other problems, such as increasing the levels of nitrates in streams and encouraging an over-reliance on oil-based products.

Soil erosion is a natural process which has been going on for thousands of years. Soil is either blown from the surface by wind or washed away by running water. The latter process is called sheet wash. Today, on a world scale, soil erosion has increased to the point where it is greater than the rate of formation of new soil. In Lesotho, Southern Africa, the Ministry for Agriculture has recently estimated that 20 per cent of the best topsoil has already been lost. This problem does not just affect the less developed world. In England and Wales 44 per cent of the arable area is at risk from soil erosion. In spring, the effects of erosion can be seen when lighter coloured patches of soil appear on the hillsides. This is where ploughing has turned the subsoil onto the surface. The deposits of fine material, often a metre thick, found in valley bottoms are further evidence of topsoil losses.



FIG 1 Severe soil erosion where overgrazing has reduced vegetation cover

Population growth, the demand for more farming land and greater productivity have contributed to soil erosion in many ways. In many parts of the less developed world, population pressure has forced farmers to cultivate steeply sloping land. Soil erosion is likely when heavy rain storms occur on land which is not well protected with a cover of vegetation. Elsewhere, such as in the mid-west of America, long term rotations using grass or hay have been abandoned in the interests of improving efficiency. Instead, rows of crops, such as maize and soya beans, are grown continuously throughout the year. This reduces the amount of organic matter binding the soil together and leaves the soil between the rows exposed to wind and water erosion. In other areas, farming has been extended into semi-desert regions where the land is vulnerable to wind erosion after the soil has been ploughed and the vegetation has not yet grown to bind it.

- 1 Figure 1 shows the effects of severe soil erosion where overgrazing has reduced the vegetation cover.
- Make a sketch of the scene in the photograph and label the following: Gullies; Bare surface; Few trees.
 - Explain what is meant by the term 'soil erosion'.
 - With the help of Figure 2 explain how the deep gullies have formed.
 - Why is it important to reduce soil erosion?

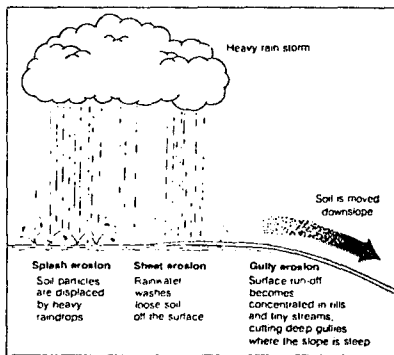


FIG 2 The soil erosion process

- Make a copy of Figure 3, which shows the location of Lesotho. Use your atlas to find and label the following: Lesotho; Maseru (the capital of Lesotho); South Africa; Mozambique; Namibia; Botswana; Johannesburg and Pretoria (the capital of South Africa).
- Give your map a suitable title.
- In which hemisphere does Lesotho lie?
- What effect do you think this will have on its seasonal pattern of climate?

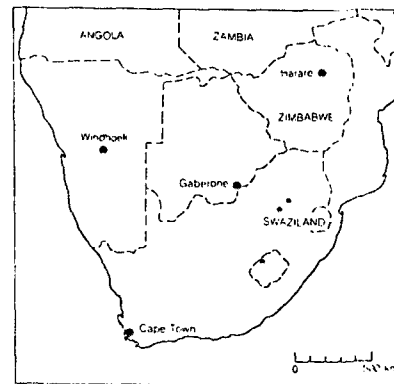


FIG 3 Southern Africa

- 3 Figure 4 shows the population totals for Lesotho from 1946 to 1985.
- Draw a line graph to show the population growth in Lesotho. It is suggested that you plot the year on the x-axis and the population total on the y-axis.
 - Use a dashed line to continue the line you have drawn to make a prediction of the population size for the year 2000.
 - Describe the pattern of population growth shown in your graph. What is the likely pattern of growth in the future?
 - The current annual growth rate of the population is 2.3 per cent. In what ways do you think this may hinder economic development and put pressure on resources in Lesotho?
 - Outline some of the ways that population pressure could be reduced.

Census date	Total population
1946	656 748
1956	793 639
1966	972 025
1976	1 216 815
1984 5*	1 500 000

* estimate
FIG 4 Population totals in Lesotho

- 4 Figure 5 shows the main geographical regions of Lesotho.
- On a large copy of this map, use the information from Figure 6 to show the population density of the regions. You could show this by density shading – shading the regions with the highest density of population in the darkest colours.
 - From your map describe the distribution of the population.

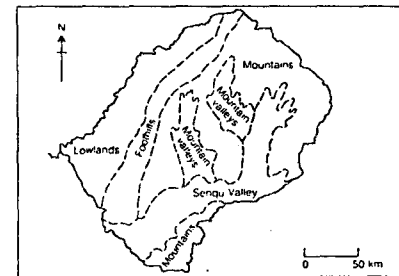


FIG 5 Lesotho's geographical regions

Region	Average population density (persons/km ²)
Lowlands	103
Foothills	42
Mountain valleys	25
Sengou Valley	49
Mountains	14

FIG 6 Population densities in Lesotho

- 5 In the early 1970s an aerial survey was carried out to identify how much farming took place on land unsuitable for cultivation. This gives a clear indication of the pressure on land resources. The results of this survey are shown in Figure 7.
- On or near the map you have drawn for Question 4, use the information in Figure 7 to draw a bar for each region to show the percentage of unsuitable land which is being farmed.
 - Either From your map, describe the pattern of use of unsuitable land.
Or What conclusions do you draw on the nature of population pressure on available agricultural land in Lesotho now and in the future?

Region	Percentage of cultivated area on unsuitable land (i.e. slopes > 9°)
Lowlands	8.6
Foothills	37.9
Sengou Valley (including mountain valleys)	49.8
Mountains	81.1

FIG 7 Farming on unsuitable land

Over 90 per cent of Lesotho's population live on the land and depend on crop farming or animal rearing for their livelihood. As a result of population pressure on available land, farm holdings have become more scattered and smaller (the average size is now less than 2 hectares). Nearly 15 per cent of rural families have no

land at all. As you have seen, population pressure has forced farmers to cultivate land which is unsuitable for farming. Much of this land is steeper than 9°, which makes it vulnerable to the erosion process illustrated in Figure 2. In addition, grazing in the mountainous areas has increased the problem. The size of herds rather than their quality is more important in traditional Lesotho society and the loss of vegetation cover due to overgrazing has led to further soil losses.

- 6 Figure 8 shows a model of soil erosion associated with overcultivation and overgrazing, particularly on steep slopes.
- Make a copy of the model shown in Figure 8.
 - Use the model to write an explanation of how (i) overcultivation and (ii) overgrazing can contribute to soil erosion.
 - Soil is eroded and transported in the model by running water. Where do you think this sediment will be deposited? What problems may its deposition cause?
 - Draw your own model to show how overcultivation and overgrazing can accelerate wind erosion.

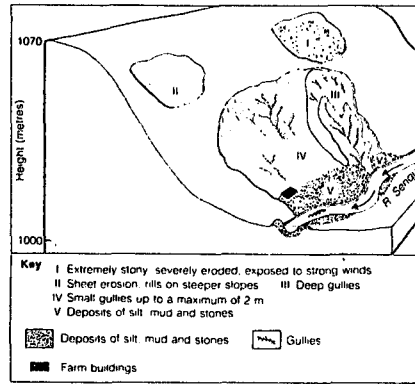


FIG 9 Soil erosion on the Koro farm

- Study the information given in Figures 9-12 and try to imagine the problems the Koro family face in farming their land.
Either Write an account of the problems the Koro family face in farming their land.
Or Work in pairs to produce a discussion between Mrs Koro and an official of the Ministry of Agriculture who is trying to help the Koro family to solve their soil erosion problem as part of the Basic Agricultural Services Programme that the government provides.
- Study Figure 13, which gives details of possible solutions to soil erosion. Imagine you are an official from the Ministry of Agriculture, and produce a report for the Koro family explaining how they can reduce their soil erosion and so raise their yields. You should include a map of the farm to show the exact location of the measures you propose.

- 8 (a) Do you think the Koro family will like and follow the advice that you have given them? Give reasons for the view that you hold.
- (b) How much allowance do you think should be made for traditional views and land ownership when devising a development plan for agriculture? Justify your answer.

Year	Maize	Wheat	Peas	Beans
1950	12	10	10	3
1960	7	9	7	2
1970	5	5	6	3
1977	5	5	6	3

FIG 10 Average yields of selected crops in the Senqu Valley (kg/ha)

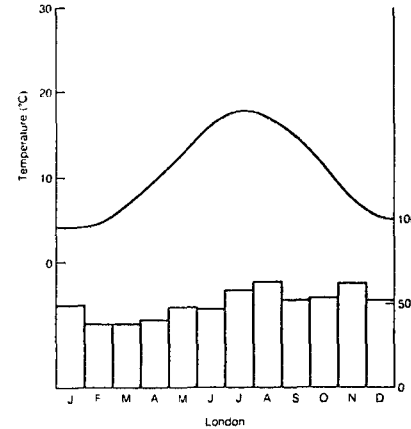


FIG 11 Rainfall and temperature conditions in London and Lesotho

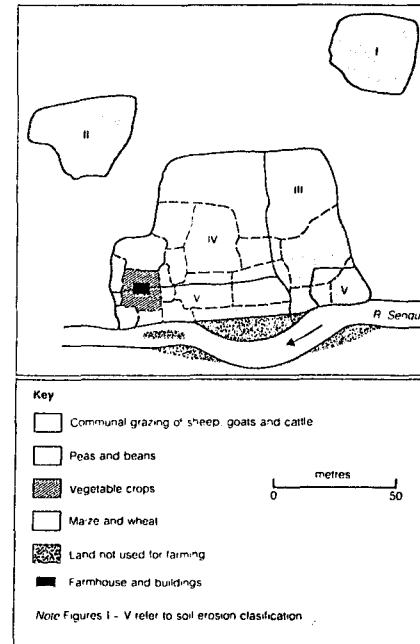
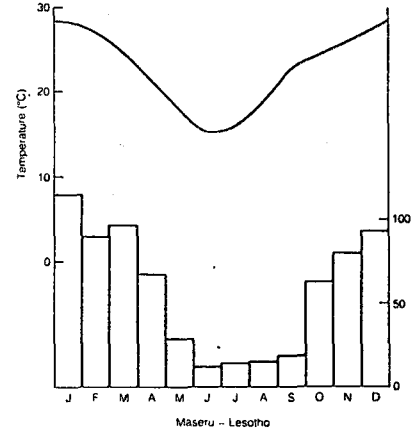


FIG 12 Land use on the Koro farm



Soil Conservation Measures

SHEET AND RILL EROSION:

On gentle slopes use CONTOUR PLOUGHING.

On steeper slopes use CONTOUR STRIP CROPPING with a minimum of 30 metres of grass between each ploughed strip, or TERRACING.

GULLY EROSION:

Small gullies can be FILLED with a bulldozer or by hand and then SOWN WITH GRASS.

Gullies up to 2m in depth should be fenced off and planted with trees, bushes, prickly pear and grass.

Deeper gullies usually need a dam to hold back the water. In extreme cases, no attempt is made to fill or sow, instead quick growing trees, such as *Eucalyptus* sp., are planted.

WIND EROSION:

If the soil is dry and bare it may be blown away. A simple measure is to plant lines of trees as WINDBREAKS either facing the main wind direction or around the edge of fields.

FIG 13 Soil conservation measures

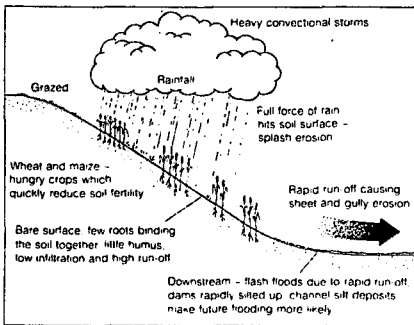


FIG 8 Soil erosion model associated with overcultivation and overgrazing

- 7 Mrs Koro is managing their family farm in the absence of her husband, who is working on a one year contract in nearby South Africa. The Koros were allocated nearly 2 hectares of land in the Senqu valley by the chief of their tribe when they were married. In common with the traditional practice, they were given three parcels of land; one good, one fair and one poor. Mrs Koro's land holdings are shown in Figure 9.
- The Koros also own a herd of 17 cattle, 35 sheep and 20 goats, which they will need as a 'bride price' when their daughters marry. They do not own their land, and once the harvest is over any member of the tribe can graze their herds on the land. As a result, vegetation cover is poorly established between harvests, and the Koro family have little incentive to improve their farm and try to halt the soil erosion.