

AN INVESTIGATION INTO THE PROBLEMS ENCOUNTERED BY  
PUPILS IN THE FORMER TRANSKEI IN UNDERSTANDING THE  
MODELS USED IN GEOGRAPHY TEXTBOOKS IN SENIOR  
SECONDARY SCHOOLS

by

NONDUMISO NTIKINCA

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## ABSTRACT

There is mounting interest in South Africa on the problems faced especially by the disadvantaged group of school pupils in the classroom. This problem also confronts academics in many countries especially in those referred to as the Third World. This interest has arisen due in part to the important position of educational achievement today as a means of raising living standards and in part to the past neglect in these countries of the factors causing variations in academic achievement. In South Africa the advent of a new political dispensation has focussed attention on this problem as a means of raising living standards and also ensuring that the country is well supplied with skilled manpower.

Arising from the background given, this study set out to investigate the problems being encountered by secondary school pupils in the former Transkei in the understanding of models. The study was founded on the notion that models are used extensively in school textbooks and that a proper understanding of them will improve overall academic achievement.

Three hundred and forty one (341) high school pupils were selected for the study. Two instruments were used to investigate the problems encountered by the school pupils (a) a researcher designed-test based on a selection of models used in their Geography textbooks and (b) an attitudinal survey on models.

Certain variables were selected to form the basis for the analysis of the results. The techniques used for the analysis of the data included means, percentages, correlations etc. Factor analysis, which is a multivariate statistical technique, was employed in the analysis to group the selected variables (based on the contributions of their variances) in an attempt to identify the main group of factors responsible for variations in the level of understanding of the models among the pupils.

The investigation revealed the following information:

- (i) home environmental conditions were the most important cause of differences in the level of understanding of the models.
- (ii) the home environmental conditions are related to certain socio-economic conditions operating within the country.
- (iii) teacher practices, as it affects teaching methods and supplementary instructions that come through field excursions for instance, can significantly improve the level of understanding of the models.

From the findings, it has been proposed that besides more teacher enrichment programmes, assistance towards the upliftment of the living standards of the people will be one major means of improving the level of understanding of models among school pupils in the former Transkei. It has also been suggested that a population policy that concentrated on exposing the vast majority of rural residents to the use of contraceptives through adult education programmes will be another means of helping pupils to improve their level of understanding of models.

## DECLARATION

I hereby state that the whole of this thesis unless specifically indicated to the contrary in the text, is my original work and has not been submitted for a degree in any other university.

  
.....  
(Nondumiso Ntikinca)  
1996

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I hereby declare that the opinions expressed or conclusions arrived at are those of the writer and are not to be regarded as a reflection of the views of the above-mentioned people.

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## *CHAPTER ONE*

# **BACKGROUND**

### **1.1 The Nature of the Problem**

The search for effective teaching/learning strategies has been a preoccupation of Geography education for several decades. In recent years increasing attention has been focused on which geographical concepts to teach and how to teach them.

Models - because of their commitment to simplicity, selectivity and emphasis on general relations - have been found to be one of the most useful devices of communicating conceptual knowledge and ideas to children (Dunlop, 1976; Slater, 1982; Chorley and Hagget, 1967; Hall, 1976). For instance, one of the most useful models used by geographers is the map. Ratzel has infact noted that 99% of all what the geographer does can be shown in the form of maps - implying that there is only 1% which cannot be shown by maps (Ratzel, 1892). The real world is also too complex and models exist to present reality in simpler forms. It is therefore not surprising that syllabuses and school textbooks in Geography are continuously making use of models ranging from the simpler three-dimensional block models to the more difficult, theoretical, symbolic and abstract models.

A review of the relevant literature reveals that though theoretical models are such useful learning devices, they are not without pitfalls. They have been found to be too abstract for some children to understand (Dunlop, 1976). Another problem arises from making the models the focus of study, which results in rote memorisation of the model without understanding the underlying concepts or potential application of the model (Hall, 1976; McElroy, 1984).

In developing models to represent the real world, there has always been a need to achieve simplicity, resulting in a number of details sometimes being lost. It is also known that models depend upon one's insight into reality. For some people, these insights are purely subjective and for such people models become emotional investments that lose all objectivity.

Besides the problems outlined above, there are specific problems connected with the use of models which particularly relate to the Transkei (for convenience the former Transkei will be mostly referred to hereafter as the Transkei). Firstly, these concern the fact that models are presented in textbooks written by authors who come from outside the region and are therefore orientated towards 'foreign' perspectives. Secondly, the language of presentation of the illustrations would be a second language for the vast majority of pupils in the Transkei. Models used in the textbooks also do not come with adequate explanatory text to aid understanding. Lastly, the overcrowding of the classrooms - coupled with the serious lack of other teaching facilities - limits the effectiveness of models on their own as teaching aids. As a result of these problems, the pupils' understanding of concepts that should flow from the use of models cannot be taken for granted.

From my experience as a teacher and examiner in the Transkei, pupils in Secondary Schools - as well as student teachers in Colleges of Education - have a problem in understanding models. At matriculation, the problem of understanding models is reflected in the persistently poor performance in Geography, compared to other subjects. This is clearly illustrated in Table 1.1. The table reveals that passes in Geography have often been either the poorest overall (1986 and 1988) or at best third from the bottom (1985, 1989, 1990).

From these statistics, it can be deduced that the failure rate among the candidates who write the Transkei Senior Certificate examinations in Geography (Higher Grade) is more than 80% in most years.

**TABLE 1.1 : PERCENTAGE PASSES (HIGHER GRADE) IN SOME SUBJECTS  
IN THE TRANSKEI STANDARD TEN (SENIOR CERTIFICATE)  
EXAMINATION RESULTS: 1985-1990.**

SUBJECT	%PASs	%PASs	%PASs	%PASs	%PASs	%PASS
	1985	1986	1987	1988	1989	1990
XHOSA 1ST LANGUAGE	91.1	94.8	92.1	92.1	86.5	91.7
S. SOTHO 1ST LANGUAGE	89.9	84.5	90.8	97.1	94.3	97.9
ZULU 1ST LANGUAGE	89.7	74.4	71.4	100	83.7	100
ENGLISH 1ST LANGUAGE	55.6	100	100	100	74.1	58.3
ENGLISH 2ND LANGUAGE	61.5	67.5	47.5	57.0	88.0	87.4
AFRIKAANS 2ND LANG.	36.1	28.9	22.3	22.6	45.4	42.3
MATHEMATICS	14.5	22.9	22.8	32.8	17.1	18.5
PHYSICAL SCIENCE	9.8	27.0	22.3	23.7	23.8	21.5
BIOLOGY	25.5	42.7	37.6	34.5	37.4	26.2
HISTORY	33.2	39.7	35.8	32.1	35.8	32.4
<b>GEOGRAPHY</b>	<b>18.0</b>	<b>11.7</b>	<b>19.6</b>	<b>20.3</b>	<b>17.5</b>	21.7
ECONOMICS	39.2	50.4	53.0	54.9	44.5	40
BIBLICAL STUDIES	21.0	33.1	43.0	29.6	34.8	32.1
ACCOUNTING	21.8	29.1	31.6	24.8	24.6	24.8
AGRICULTURAL SCIENCE	13.3	22.8	10.6	22.1	11.9	15.3
HOME ECONOMICS	28.4	33.0	67.4	31.1	29.4	27.6

Source: Summary of Examination Results, Department of Education, Umtata, 1990

A distinct lack of research has been noted in what exactly happens when students are presented with textbook illustrations (Warwick, 1987; Mayer, 1989) and specifically on models and related instructional issues (Mayer, 1989). A teacher's knowledge of children's cognitive abilities, which necessarily shape their perception of theoretical models, is of vital importance. This knowledge is essential in the selection of appropriate

models and for the tailoring of their use (Hilary, et al., 1988), especially in a region like Transkei.

## **1.2 The Rationale of the Study**

This study has been prompted by the following factors:

1. The use of appropriate teaching strategies is very important to the success of the learning process. The success or otherwise of the strategy used in teaching tends to be reflected in the performance of pupils. The complexities of the modern world have reinforced the prime importance of learning as a means of survival and of social mobility, especially among disadvantaged communities. The importance of academic achievement lies in the fact that it helps one in securing some kind of employment, in obtaining recognition and influence in society, and in retaining the respect and affection of one's family. One's level of school attainment, which is a function of one's level of academic achievement, is a measure of one's status in society and determines one's leadership prospects. In short, it is a measure of one's prospects in life.

Arising from the above-mentioned factors, it is not surprising to note that academic achievement does affect a student's life in many ways. It can have a strong influence on a student's self-image (Griffore and Samuels, 1978) and on his relationship with other students (Taylor, 1964).

Even after graduating, poor results can keep a student from pursuing further education (Lewis, 1974) or obtaining a desirable job (Gordon, 1974). Thus, college students in the United States of America, for instance, frequently mention college grades as a major source of anxiety in their lives (Vincent, 1970). Indeed, Schechter (1974) estimates that

between one third and one half of all young people seen in psychological clinics in the developed world are referred primarily because of learning problems. According to Blaine and McArthur (1971), concern about college grades account for over half of all requests for counselling in the USA. Thus, a study such as this one which examines the problems of conceptual understanding of models as a part of examining the factors underlying variations in the academic achievement of students has always been realised as a necessary component of the educational provisions (Coladarci, 1959). The importance of academic achievement is also reflected in the economic development of a country. For example, Golden (1955) found a correlation between literacy and economic development in the developing countries and obtained a positive correlation co-efficient of 0.98. Transkei's first five year development plan also envisaged that education would continue to play a unique role in the social transformation process of the country (First Five Year Plan 1981/82 - 1986/87).

2. The adoption of appropriate teaching strategies is also at the very heart of a teacher's work. Lack of an effective strategy is a waste of time besides not yielding the results envisaged. Indeed, teachers often experience considerable anxiety when his/her students perform badly in their examinations (Gage, Runkel, and Chatterjee, 1960).

The nature, method and other factors affecting the use of models also enable a teacher to determine the strength and weaknesses of his/her students so that he/she can modify his teaching accordingly (Blair et al., 1975). As Blair sums it up, a 'teacher who knows a great deal about learning but little about the learner is only half prepared' (Blair, et al., 1975:120). A study of the factors concerning the use of models will therefore help teachers to adopt more efficient teaching strategies so that they can be of better help to their pupils.

3. In spite of the considerable importance of the use of models, not many studies have been conducted on the subject - especially in the Transkei. There is, therefore, a need for further investigation into this aspect of education.

4. If increased attention is not paid now to the problems connected with the use of models in the Transkei, Geography education in the region will never improve.

The Taylor report (1979) which has been used in the past to guide education policy in the Transkei, states that education should be able:

"To provide such insight into the bases of the disciplines studied as will enable the student to analyse data, present findings based on properly obtained evidence and to use knowledge gained, not only in related situations, but also to obtain further insight and so prepare the student for more advanced study.

To continue to develop long term interests of a specialised nature related to future studies of both an academic and vocational nature as well as recreational and to provide opportunities for creative activities in relation to those where relevant".

(Report of the Taylor Commission, 1979:98).

These objectives, according to the Department of Education in the Transkei, will also enable :

"... each citizen to recognise his potentialities and develop within the limits of his capacities, interests and needs, develop intellectually and be a clear thinker, develop maximum facility in the use of language, be healthy and physically fit, earn a satisfactory living in a vocation of his own choice, interpret his Christian ideals through the quality of his interaction with others in his daily life, make the best use of leisure time through sport, music, literature and art, virtues of honesty, unselfishness, develop so as to take up the responsibilities of family life and contribute to the welfare of his community, and lastly, develop ideals of citizenship and understand that he is also a world citizen"

(Hansard, 1979:231).

Vast sums of scarce capital are invested every year on the education and training of the young people so as to achieve these objectives. To the Transkei in particular, this

represents a sacrifice which does affect the provision of other services as the capital available is limited. However, these objectives can only be realised when it is based on an intensive investigation of the educational process so that inherent constraints could be removed and future ones provided for. As Szentes (1971) states: "it is impossible to bring about a deliberate and purposeful change in the present without knowing how this state came about. We can't successfully fight any phenomenon without knowing its roots" (Szentes, 1971, p.2). Therefore, there is a need for a study into the various aspects of the educational system now so that the system is made more efficient to serve the needs of a modern nation. It is hoped that this study will be of assistance to the educational planning authorities in the Transkei, especially as Geography as a subject is of an interdisciplinary nature so that the impact of any improvements in its study is likely to be felt in other subjects.

5. The introduction to the Transkei secondary school Geography syllabus exhorts teachers to use "theoretical models (such as urban and economic models) which need to be tested against the real world and enable generalisations to be made. These enable Geography to be studied by means of a more problem-orientated approach" (Syllabus introduction, p. 3). Thus a study of the problems relating to the conceptual understanding of models becomes a relevant undertaking.

6. An examination of some of the Geography textbooks used in the Transkei reveals that models are used extensively in them. Such is the case in textbooks like *New Window on the World* and the *Senior Geography* series. Therefore, no Geography teacher can teach and ignore these. It is with this in mind that a continuous search ought to be made to find the best way of using the models for teaching.

7. In the wider world, there is ample evidence from several studies to show that there are ethnic group variations in the factors that determine success in the learning process (Majoribanks, 1984; Clark and Halford, 1983). Taylor (1971), for instance, from his studies of some Pacific peoples, concludes that they have difficulty with abstract reasoning which accounts for their poor academic achievement. He attributes this problem to certain environmental factors. Mulford and Young (1973) corroborate Taylor's conclusions with their studies in Papua New Guinea. This study will, therefore, enable others to understand the problems of conceptual understanding of models used in Geography textbooks by Transkei pupils. It will also recommend appropriate strategies for their use in teaching. The body of information thus gathered should add to the knowledge on models and their use in general.

### **1.3 The Study Region**

This study was undertaken among some high schools within the Butterworth District of the former Republic of Transkei. Financial and other logistical constraints were the major factors in the selection of the study region. As will soon be apparent, the extent of homogeneity in the region makes it possible to generalise the results of this study in spite of the fact that the research was conducted in only one of the twenty eight magisterial districts in the Transkei. Transkei was incorporated into the Union of South Africa in 1910. The territory attained self-government in 1963 and became virtually independent in 1976. Transkei however, has been re-incorporated into the Republic of South Africa as from the 27th April 1994 General Elections. At the time of this research however the Transkei existed as a separate homeland.

The territory of the Transkei is situated within latitude 30 degrees south and 33 degrees south and longitude 27 degrees east and 30 degrees east. It occupies 42,240 sq km

between the Drakensberg mountains to the west and the Indian Ocean to the east and between Natal\Kwazulu to the north and the Great Kei River to the south.

Transkei is essentially a region of transition and homogeneity. Topographically, the transitional character is one of change, ranging from the Cape folded mountains and karoo basins in the south to the more undulating country towards Natal. Right from the sea, the land rises gently towards the Drakensberg mountains. In places the gentle relief is only broken by the valleys of the numerous rivers that flow through the country. Climatically, Transkei's transition is from the comparatively even distribution of rainfall along the coast to the distinct summer precipitation of the interior. Winter temperatures in most places range from mild at the coast to cold inland. Winters in especially the interior are dry as rain falls mainly in summer. The vegetation is also transitional, ranging from evergreen coastal forest through thornveld to open mountain grassveld toward the Drakensberg.

The homogeneity that is associated with Transkei's population can be observed in many respects. For one thing, the vast majority of the population (95%) are Xhosa-speaking, a sub group of the Cape Nguni. Except for minor differences, these people share the same customs and traditions. As Dischl observes, "while all other tribes in Transkei are not true Xhosa, they are held together by the bond of the Xhosa Language" (Dischl, 1982:6). Another point to note is that, of a total population of 2.7m (1985 census report), the vast majority of the people are peasant farmers and therefore directly dependent on the land for their daily existence. Less than 10% of this population live in towns as defined to be settlements with a population of 5,000 and over and most are illiterate. Wakelin (1983a), estimates that Transkei's illiteracy rate has dropped from 88% in 1980 to 75% in 1983. He also concludes that the average number of years of

schooling for rural adults is 3 and for urban adults 6,5 years. Of all school leavers, 2% obtain senior certificates, 0,4% obtain matric exemption while 55% leave school illiterate and 20% leave semi-illiterate.

In the Transkei labour migration, public sector spending, and industrial incentives are the major determinants of the economy (Brand, 1986). One of the most important features of this economy is the low per capita Gross Domestic Product (in 1991 it was R105, while the per capita Gross National Income for the same year was R123). The other is the lack of employment opportunities. In 1991 the Transkeian economy could provide employment in the agricultural sector for only one third of its male manpower. Half of these people were and still are in the civil service. The vast majority of the economically active population inside the Transkei are employed within the agricultural sector (Transkei Department of Commerce, Industry and Tourism, 1991:23). Although the agricultural potential is high, the actual production per unit is extremely low, and food must be 'imported' from elsewhere in South Africa. Only ten per cent of the agricultural produce is sold (Annual Report of the First National Bank, 1990:7)

Most of Transkei's labour force work as migrant workers in the mines and industries elsewhere in South Africa. For instance, of a male labour force of 670 000 in 1980 (when the Transkei was still an independent homeland, before it became part of the Republic of South Africa) 450 000 were working as migrants elsewhere in South Africa (Transkei's First Five Year Development Plan 1981/82 - 1986/87). As at the end of 1991 more than half of the male labour force were working as migrant workers elsewhere in South Africa.

Unemployment in the Transkei is one of the highest in the world. The limited domestic employment prospects are very clearly revealed in the structure of Transkei's labour force indicated in Table 1.2.

**TABLE 1.2 : THE STRUCTURE OF THE LABOUR FORCE IN TRANSKEI - 1982**

VARIABLE	NUMBER	TOTAL %
LABOUR SUPPLY	1 017 000	100%
LABOUR DEMAND:		
External	420 000	41.3%
Formal	195 000	19.2%
Informal	65 000	6.4%
Subsistence	150 000	14.7%
Unemployed	187 000	18.4%

Source: Muller, (1983)

From the above table, it is clear that most of Transkei's able bodied labour force find employment outside the Transkei almost exclusively in the mining industry of the Republic of South Africa. Based on the assumption that about 21.1% of the labour force is employed in the informal subsistence sector (Muller, 1983), a residual of 187 000 people are estimated to be unemployed. In recent times, employment in the key mining sector has stabilised and there has been a problem of finding other employment avenues for the ever increasing number of people entering the labour market.

Unemployment affects the ability to provide the means to educate one's child. With so many unemployed people therefore, several children are at risk in the provision of basic school materials. Unemployment affects the rural areas more since opportunities for

obtaining work are less there. Unemployment is also related to the rate of migration (Todaro, 1975).

Table 1.2 also indicate the high rate of migration due to the unemployment situation. As at the end of 1977, 60% of the male labour force of Transkeians were working as migrants in the Republic of South Africa (Thomas, 1982, p. 35). Table 1.3 points to the obvious importance of the system of labour migration to the economy of the Transkei.

**TABLE 1.3 : TRANSFERS FROM MIGRANTS' EARNINGS IN THE REPUBLIC OF SOUTH AFRICA TO THE TRANSKEI ECONOMY - 1985**

<b>TOTAL EARNINGS</b>	<b>100%</b>	<b>R 1 845 000 000</b>
Cash Remittances	25%	R 460 000 000
Deferred Pay	15%	R 275 000 000
Cash Brought Home	3%	R 55 000 000
Goods Brought Home	5%	R 95 000 000
<b>Total Transferred</b>	<b>48%</b>	<b>R 885 000 000</b>

Source: Department of Finance, R.S.A. (1985).

Indeed the estimated earnings of labour outside the Transkei in 1975 was R380m - almost double the GDP of the Transkei that year (Muller, 1983).

Labour migration occurs mostly in the rural areas where the bulk of the population lives and where opportunities for securing work are almost non-existent. Infact, rural incomes in the Transkei are derived mostly from the remittances of migrants (Thomas, 1984).

Due to the migratory labour system the Transkeian population is dominated by women. Table 1.4 shows the male absentee rate (%) in different parts of Transkei as at the end of 1985.

**TABLE 1.4 : MALE ABSENTEE RATES (%)**

AGE	ROZA	NTSHIQO	NAKANGA	UMZIMKULU	RURAL TRANSKEI
15-19	7.25%	14.05%	16.27%	28.38%	13.52%
20-24	44.74%	70.00%	64.71%	70.69%	52.82%
25-34	67.01%	80.82%	88.14%	88.89%	69.93%
35-44	57.89%	80.43%	85.71%	87.76%	69.96%
45-54	64.00%	52.94%	77.14%	71.05%	46.82%
55-64	29.17%	32.25%	50.00%	44.12%	35.02%
65+	6.25%	14.29%	14.29%	4.55%	7.27%
<b>TOTAL</b>	<b>26.26%</b>	<b>33.47%</b>	<b>34.30%</b>	<b>35.98%</b>	<b>30.08%</b>

Sources: Moll (1984) - Roza; Muller and Tapscott (1984) - Ntshiqo and Nkanga; Wakelin (1983) - Rural Transkei; May (1984) - Umzimkulu

In the absence of the males, women in the Transkei are made to take on far greater responsibilities than in most other societies. They are responsible for child rearing, home making, home food production, and livestock caring. In 1979, for instance, it was noted that 51.2% of the heads of households were women (Thomas, 1985). The situation is much the same if not worse today. The majority of children, therefore, stay with and derive intellectual stimulation from only the mother whose time is also taken up by home making and earning a living.

Average income in the rural areas, where the vast majority of the people reside was, given as R194 per annum with illiteracy pegged at 88% in 1980 (Republic of Transkei, Five Year Development Plan, 1981/82 - 1986/87). In sum therefore, Transkei's population is predominantly mono-cultural, rural, poor, peasant farmers, and the majority of males are migrants working outside its borders. These characteristics will become important later on in the examination of the underlying factors to the observed relationships.

The homogeneity that has been described above has important implications for the study. For one thing, it allows one to assume broadly uniform home conditions so that the effects of variations in school practices (with the use of theoretical models) on academic achievement can be assessed. For another, the importance of small differences in home conditions on the understanding of models of students can be evaluated.

The Butterworth District, in which the research was centred, lies towards the southern part of the Transkei. It has an area of 664 km square which forms barely 2% of the total area of the Transkei. As in all other areas of the Transkei, the District can be divided into the Urban (comprising the area within the municipal boundaries of Butterworth) and the Rural (comprising the rest of the region). Besides the geographical dimension, this division also relates to differences in certain socio-economic factors. The rural areas are characterised by very low incomes, poor housing conditions, large communal living, and the major economic activity is farming. Urban incomes are mostly derived from the public sector which throughout the country represent the employment of one in every 4 households (Department of Finance Statistics, 1986). With state subsidisation of industry and growth in public sector employment, urban sector incomes are much higher than rural sector incomes.

The overall index of 0,580 is one of the worst in the world and confirms the views of Thomas (1982) that, "...for the bulk of the rural Transkeians the income gap vis-a-vis the urban elite has widened" (Thomas, 1982; p. 83). The cumulative effect of budgetary support and subsidies to industry, therefore, has been to produce income inequalities between rural and urban incomes.

Table 1.5 indicates income distribution between rural and urban residents of the Transkei.

**TABLE 1.5 : INCOME DISTRIBUTION - URBAN & RURAL - 1982**

RANDS PER HOUSEHOLD	URBAN		RURAL		TOTAL	
	%	CUM %	%	CUM %	%	CUM %
R 1-200	2.69	2.69	6.75	6.75	5.58	5.68
R 201-400	1.95	4.64	10.11	16.86	7.95	13.63
R 401-600	1.47	6.11	10.15	27.01	7.85	21.48
R 601-800	3.67	9.78	14.53	41.54	11.64	33.12
R 801-1 000	2.69	12.47	8.57	50.11	7.01	40.13
R 1 001-1 500	5.50	17.97	13.16	63.27	11.13	51.26
R 1 501-2 000	2.93	20.90	6.67	69.94	5.68	56.94
R 2 001-3 000	12.47	33.37	6.93	76.87	8.40	65.34
R 3 001-4 000	19.09	52.46	6.45	83.32	9.79	75.13
R 4 001-5 000	12.10	64.56	5.69	89.01	7.40	82.53
R 5 001-7 500	14.79	79.35	5.30	94.31	7.82	90.35
R 7 501-10 000	8.68	88.03	2.69	89.00	4.28	94.63
R 10 001-15 000	6.11	94.14	2.12	99.12	3.18	97.81
R 15 001-20 000	2.44	96.58	0.44	99.56	0.97	98.78
R 20 001+	3.42	100.00	0.44	100.00	1.22	100.00
<b>GINI INDEX</b>	<b>0.456</b>		<b>0.537</b>		<b>0.580</b>	

Source: IMDS Income and Expenditure Survey.

Besides, the large gap between rural (where the bulk of the population resides) and urban incomes, it is clear that many Transkeians earn incomes far below the subsistence level. The Institute of Planning Research in Port Elizabeth conclude from the income figures that about one third of urban households and three quarters of the rural households in the Transkei fell below the household subsistence allowance in 1982.

Rural residents are thus generally poorer and less educated than those in the urban areas (Thomas, 1985). Rural residents are also more likely to have many children and at short intervals due to the lack of knowledge of contraceptives and the general lack of something else to do. These factors have been shown to have great influence on academic achievement (Reid, 1977). In the urban areas on the other hand, incomes are much higher, housing conditions are better, and economic activities vary from commerce, through industry, to finance. Urban residents are also more individualised and the basic family unit is the nuclear family. In view of the considerable importance that environmental factors have been given in studies of the factors accounting for differences in academic achievement, the division presents the contrast that exist within the homogeneity. These factors will be taken into consideration in the selection of the sample size.

During the last census (1985) 75494 people were listed as living within the District (0.04% of total population of the Transkei) divided into 32838 males and 42656 females. As referred to before, the vast majority of this population (95%) are Xhosa speaking. The rural population was given as 48 151 and urban population was said to be 27 343. Urban population growth rate has been very rapid (36%pa) with the result that Butterworth District now has the highest percentage of urban to rural population by district in the whole of the Transkei (Muller, 1984). This is due mostly to the selection of Butterworth as an industrial growth point and the consequent growth in industrial establishments. At one point Butterworth had over 50% of all industries in the Transkei. It is not surprising that urban population density - at 2 486 per square kilometre - is the highest in the Transkei. However, rural population density in the district - at 72 per square kilometre - is moderate. Table 1.6 below lists the population by age group within the district.

**TABLE 1.6 : POPULATION BY AGE GROUP - BUTTERWORTH DISTRICT - 1985**

AGE	AGE	AGE	AGE	AGE	AGE	AGE	AGE	AGE
>5	5-14	15-24	25-34	35-44	45-54	55-64	65-74	75+
11 487	19 408	15 176	10 022	7 320	4 896	3 474	2 576	1 135

Source : Census Report, 1985, Republic of Transkei.

The large number of children of school going age is obviously of concern here. For this many children, there are 94 schools divided into 4 pre-schools, 18 Junior Primary Schools, 20 Senior Primary Schools, 40 Junior Secondary Schools, 10 Senior Secondary Schools, 2 Teacher Training Colleges and 1 Vocational Institute. Table 1.7 below gives the number, sex and qualifications of the teachers in these schools.

**TABLE 1.7 : QUALIFICATIONS OF TEACHERS  
BUTTERWORTH DISTRICT, 1990**

QUALIFICATION	MALE	FEMALE
Junior Certificate and lower	59	338
Senior Certificate	139	178
Partial Completion: Degree	5	3
Professionally Qualified	241	549
Professionally Unqualified	24	16

Source: Circuit Office Files, Dept. of Education, Butterworth, 1990.  
(Professionally qualified implies having a Teacher's Certificate in addition to academic qualifications)

Within the district there is a 70% enrolment of school age children of which 29% are in secondary schools. Pupil classroom ratio stands at a high 1: 53 (Butterworth Master Plan 1987). In addition to the educational establishments listed above, Butterworth also hosts the Transkei Technikon's main campus and a branch of the University of Transkei.

## **1.4 Objectives of the Study**

This research proposes to investigate the problems encountered by pupils in understanding models. The specific aims of this study are:

1. To identify and classify models used in the Standard 8 to Standard 10 Geography textbooks used in the Transkei schools.
2. To analyse typical examples of models in relation to the way pupils understand them.
3. To assess the level of understanding of the models used in schools in the Transkei.
4. To examine the way the selected models are used in schools in the Transkei.
5. In the light of the findings above, to recommend appropriate strategies that will enhance the understanding of models in schools in the Transkei.

## **1.5 Organisation of the Study**

The study consists of six main chapters. These are preceded by preliminaries, including an abstract. At the end there is a conclusion. The six main chapters cover different aspects of the study as follows:

Chapter One, reviews the background to the study. It is devoted to stating the problem, providing the rationale for the study, describing the study region and stating the objectives of the study.

Chapter Two reviews the literature on the problem and places the research within the context of research into the use of models in general. From the review the variables which will guide the data analysis will be selected. Chapter Two will also outline the proposed hypotheses.

Chapter Three describes the research methodology including the sample, instruments and the techniques used for the analysis of the data collected.

Chapter Four and Chapter five both present the results of the research. While Chapter Four examines the general research findings, Chapter Five employs the use of statistical techniques as a way unearthing the factors and forces underlying the observations in Chapter Four.

Chapter Six presents teacher practices and draws conclusions on their possible effects on the level of understanding of models among school pupils in the Transkei.

The conclusions and recommendations including other possible areas of study are presented in Chapter Seven.

## *CHAPTER TWO*

# **THEORETICAL AND CONCEPTUAL FRAMEWORK**

### **2.1 Introduction**

Having outlined the objectives of this study in the previous chapter, this chapter is intended to introduce the major concepts and theories relevant to this research. Secondary data on these will also be reviewed. Upon review, the relevant variables will be selected to form the framework within which the data are going to be analysed. The review of the concepts and theories helps to introduce order in the descriptions, simplifications, clarifications, and explanations of phenomena in a chosen region (Abler, Adams, and Gould, 1972).

These concepts and theories will also help in plan formulation as well as in providing the foundation on which predictions can be made. The examination of these conceptual and theoretical formulations gives the framework within which one can investigate the problems associated with the use of models in the Transkeian schools. The major concepts and theories relate to the explanations that have been advanced for differences in learning abilities while also seeking to clarify some aspects of teacher practices and the role that these teaching habits play in solving the problems that the teachers are faced with.

## 2.2 Theories of Understanding

Theories of understanding have been formulated with one major question in mind: why are there differences in individual levels of understanding? The consideration of differences in learning abilities or character is a consideration of the causes of variety in a population. What may differ from population to population, from individual to individual, or from time to time, is the relative importance of the different causes or precisely what proportion of the variance is assignable to each of the different causes.

The best known of these theories of understanding is that of Piaget. He identifies four major stages of development linked with mental ages. While Piaget's stages are invariant in sequence, the chronological ages associated with them are not fixed. These include the **sensory-motor stage** (0 - 2 years) during which a child's activities are characterised by movement of the limbs. These are initially unco-ordinated but gradually improve and become co-ordinated at about age two. This stage is followed by the **pre-operational stage** (2 - 7 years) during which time a child is capable of thinking at an elementary level even though egocentricity characterises his/her thinking. Then follows the **concrete operations stage** (7 - 12 years) which is characterised by logical thinking. Reasoning is, however, tied to concrete experience and is dependent on perceptual facts around the individual child. Lastly, there is the **formal operations stage** which starts from about the age of 12 and is the stage for abstract thinking.

While there have been several other theories of understanding (Kohlberg, Bruner, etc), many of these have been mere extensions of Piaget's pioneering work. Although some studies have criticised Piaget's conclusions as not being consistent with the evidence, (Ennis, 1976) several other studies (Jansson, 1977; Rabbit, 1965; Mwenwenda, 1985) agree that logical reasoning develops with chronological age. In part, the school system based on a 'ladder-plan' builds on this belief by increasing the amount of knowledge and demanding more logical structuring of answers to questions at every higher step on the ladder.

Piaget's research led him to conclude that there is a natural tendency among people to assimilate knowledge to existing conceptual structures based on obvious developmental stages. He also concludes that spatial learning results from child activity in the learning environment. Evidence in support of the construction of knowledge on the basis of existing mental structures has been reported by Rosenhan (Science, 1973, Vol. 179, p. 250). Thus, Piaget's conclusions have been accepted as being in agreement with what happens in the learning environment. The idea of knowledge as something which is constructed in the mind of the learner on the basis of pre-existing cognitive structures provides the basis for Ausubel's drawing a distinction between meaningful and rote learning.

An important implication of Piaget's work and other theories of understanding for Geography teaching is the fact that learning moves from the concrete to the abstract.

A Piagetian approach to learning in Geography would therefore tend to emphasise the need for more visual aids and activity systems and less of verbal imagery (reinforcements). The idea of a child as a sponge that absorbs knowledge is therefore rejected in this approach. Even where children are capable of abstract thinking, the value of the concrete illustration - even if it is only in symbolic form - has been realised. It has been noted, for instance, that the cognitive mapping ability (spatial perception) of the child begins at the pre-operational stage (2-7 years). At this stage children can represent the world in symbols even if the operations are intuitive. Research by Bassowitz and Karchin (1957) recommends that advantage be taken of this ability.

However, it should be noted that while the stage of formal operations is supposed to be attained at twelve, in practice not every child either in Africa or in the Western European countries attains the abilities consistent with this stage at that age (Mwemwenda, 1985; Hunt et al., 1973). It is important for the teacher to realise that, where their mental development is concerned, there is great variability between children of the same chronological age (Hunt et al., 1973).

Although based on Piaget's work, Bruner has in fact postulated a system of representation in cognitive development. He has introduced a sequential system of development in which the first stage is enactive (learning by doing), the second iconic (dependent on visual or other sensory organisation) and the third involves symbolic representation in words or language (ie manipulative images). These theories indicate stages in spatial cognition that proceeds from action-in-space to perception of space to

conceptions about space. This is the great value of models in learning. They allow a topological understanding of space to be acquired.

### **2.3 Factors Affecting Learning**

It has been noted that the Piagetian technique has not provided a complete answer of the differences that exist among pupils in understanding - especially because its applicability is limited to only a few age groups (Ennis, 1976). Various reasons have therefore been assigned for these differences.

For instance, some psychologists note certain characteristics with poor school achievers and hold these characteristics to be responsible for the pupils' poor learning abilities. Thus, Dawud attributed learning abilities to the concept of conservation (Dawud, 1984). Niles speculates that difficulties in learning may be a result of incomplete thought structure within the Piagetian framework rather than perceptual or sensor disorders often correlated with learning disabilities (Niles, 1981).

Academically weak students, have been shown to be less intelligent than their classmates (Lavine, 1983) and they quite often have worse memories (Mayer, 1989; Malaleka, 1983). They are also less likely to attend classes regularly (Kunz and Peterson, 1973; McCall and Johnson, 1972), to take notes in class (Baltes and Schaie, 1984; Heron and Chown, 1967) or to interact with their instructors either in classroom (Williams, 1970) or outside (Kunz, Nash and Brucken, 1978).

Others have attributed the problem to factors such as cognitive styles (Clark and Halford, 1983), cultural values (Cox, 1983; Harrington, 1965) and teacher failure (Watts, 1976).

At school, high achievers have been shown to be more intelligent, serious, conscientious, circumspect, imaginative, self-assured, self-sufficient and self controlled (Warbutton, 1968). These characteristics have been known to vary with age (Clark and Halford, 1983). Older successful students are reserved, emotional, excitable, competitive, shy, tender-minded, and unfrustrated. Younger successful students are out-going, stable, conforming, socially bold, and tough-minded (Warbutton, 1968). What these studies imply is that certain factors do promote learning while others do not. Knowledge of these factors would therefore make learning more effective.

One of the most comprehensive of the theories of learning and understanding, which is significant for this study, is proposed by Carrol in 1963 (Carrol, 1963). He identifies five factors as being the major determinants for learning. These are : student aptitude, quality of instruction, ability of the learner to follow instructions, student perseverance and the time allowed. While he identified student aptitude as being construed in terms of the amount of time a learner requires to attain mastery of a learning task, quality of instruction was defined as the degree to which presentation, explanation and ordering of elements of the learning task approaches the optimum for a given learner. Ability to follow instruction has been suitably explained by Bloom (Biggs 1978) as the ability of the learner to understand the nature and procedures to perform the task put before him.

In the Transkei the background of students in relation to whether they are from a rural or an urban school has a lot to contribute to this. In the Transkei the time allowed for each task is usually compartmentalised for the various subjects studied at school. Regarding time requirements, the first aspect of Carrol's theory is related to the attitude of the individual. It is specific to certain individuals. Different people require different amounts of time to learn things. One conclusion from this theory is that teaching and learning are not synonymous. One can teach, and teach well, without getting the pupils to learn anything. According to Carrol, however, given a natural population (for example all high school pupils) aptitude is evenly distributed and no such population can show one level of aptitude.

In general, the results of all studies into factors that account for the varying differences in learning abilities can be grouped into two: those that stress innate ability and those that stress ability acquired as a result of environment, training and experience. To some researchers all human competencies and other psychological traits are transmitted "directly through the genes from generation to generation" (Sprinthall and Sprinthall, 1977, Quoted from Majoribanks, 1984, p.46). To many other theorists, not only human abilities but "a person's whole being is shaped by how and in what circumstances one was raised or nurtured" (Majoribanks, 1984, p. 46). Many studies have been conducted to support one or the other contention.

The problem with all these expositions, as Crow (1969) has pointed out, is deciding on the proportion of learning ability that can be held to be either innately acquired or environmentally determined. What is clear though is that an individual's character traits

are acquired during his\her development. In order to acquire any character trait, however, the individual must have the genetic endowment to do so. From this analysis it can be deduced that human abilities (like the aptitude for learning) are multifactorially determined and that both nature and nurture are influential in its determination. That is the perspective endorsed in this study.

Even though it has been generally known that both nature and nurture count in the acquisition of abilities, an important factor in the acquisition process which has not been paid equal attention is what is referred to as the "state of readiness". Generally speaking, this refers to the importance of time. Well documented cases of human infants being brought up by animals (Halsey, 1967 refers to the case of the Feral children), show the importance of the time element in determining character. In all such cases the children were unable to learn completely all the animal behaviour when they had to. They showed deficiencies which were absent from the animals offspring. Thus Halsey argues that "heredity is partially determined by the range of variation of the environment in which it operates, and conversely that the strength of environmental determination is in part a function of the genetic variability of the population living in the environment in question at a certain time" (Halsey, 1967:2-3). The proportion of the variance assignable to genetic causes (the heritability of the character) may vary for either of two reasons. It may increase with increase of, and decrease with decrease of the amount of genetic variety in the population and secondly it will decrease with increase of and increase with decrease of the variety of environments in which the individual members of the population develop. The more uniform the environment, the greater will be the importance of genetic variety.

Instead of thus looking for an ultimate cause in either nature or nurture, a study of human related competencies must acknowledge the complexity of both genetic and environmental variables and of the time element. These must be isolated and looked on as interdependent.

This standpoint demands an acknowledgement of the complex genetic structure of man, the wide range of possible variations in human environments and the complex processes of interaction that exists between the two. This point of view has been found to be consistent "with the conception of the contemporary human behaviour as rooted in the genetic characteristics of early man" (Halsey, 1967: 6).

It is recognised that changing the innate abilities of man is not within the domain of the teacher. Therefore, attempts at improving the learning abilities of individuals has focused on the school environment. It is in recognition of this fact that several studies reflect the interest of educators in the role of teacher practices in improving learning abilities and understanding (Christensen and Massey, 1989). This is even more important in Geography education. That is because to "enable a growing child and young adult to conceptualise and set in order the dimension of space in which all human beings live" (Bailey, 1982, p. 8) demands exposure to a vast range of experiences for pupils (Levy, 1984, p. 212). Such experiences will necessarily include fieldwork and models. The extensive use of models in school textbooks also implies that school pupils ought to be taught about them. The specific constraints faced by Geography teachers in the Transkei with respect to the availability of teaching aids suggest the proper use of models as one useful tool in the hands of a "deprived teacher".

## 2.4 Geography Education in the Transkei

Education in the Transkei has responded to politico-economic developments in the Republic of South Africa. The fact that the greater portion of the labour force was and is dependent on the Republic of South Africa for employment, and the resulting fact that the manpower needs and job opportunities both lie outside the borders of the Transkei, have had great influence in determining the educational policy and the structure of the Transkeian educational system.

Formal education was introduced in the Transkei as part of missionary (mostly Methodist and Anglican) activities in 1820. The early mission schools were set up in Butterworth, Clarkebury, St Marks, Buttingville, Holy Cross, Shawbury, Palmerton, Emfudisweni, and Bensonvale (Ngubentombi, 1984). These institutions taught the three Rs and also provided industrial skills. Following the imposition of British colonial administration over the Cape Province, education in the Transkei passed into government hands. It was during this period that Geography, along with many other liberal arts subjects, was added to the curriculum (Levy, 1984).

Beginning from the early 1960s, the education system in the Transkei was run by Transkeians. It is interesting to note, however, that the links between the Transkei and the Cape Province - through syllabus control and through the provision of prescribed textbooks - had, if anything, been strengthened. The development of educational provisions was accelerated much faster in the 1970s than in the earlier period. Teacher education was expanded and more teachers were being trained in specialised subject

areas than before. Subject advisors were employed and an in-service department developed. The number of schools was also increased. The Department of Education in Umtata also retained the services of professional planners. Finally, with the initial backing of Fort Hare University, the University of Transkei was opened in Umtata.

These developments have had an impact on the way Geography is taught today in the sense that teaching techniques and the supply of equipment have been much improved. This is not to say that Geography education in the Transkei today receives the support it deserves nor is it provided with the necessary inputs it badly requires.

The 1970's also brought a noticeable change in emphasis in the teaching of Geography in South Africa with its consequent absorption by the Transkei. Textbooks as well as examinations moved away from the acquisition of knowledge by pupils towards the application and interpretation of this knowledge (Levy, 1984:211). In the Transkei, a new syllabus was introduced in 1984 to reflect these developments. It brought about the disappearance of static and descriptive Geography from the school syllabus. In this connection, the introduction to this new syllabus stresses the development of positive attitudes, quantitative expressions, systems theory, and model building.

The links between the Transkei and the Cape Education Department have meant that changes in the Geography curriculum more often come from outside rather than from within. These links have meant that problems facing black rural folk in Transkei, such as housing and water supplies, do not feature in the school Geography syllabus. The discipline is also strictly compartmentalized into areas such as Geomorphology,

Climatology, Economic Geography and the Regional Geography of different parts of the earth's surface with few links between them. The main objective has been and still is to provide pupils with factual knowledge (including the learning of models) despite attempts to emphasise skills, and concepts. These factors will obviously affect the way pupils view the discipline. As Ausubel has noted, "the most important single factor influencing learning is what the learner already knows" (Ausubel, Novak and Hanesian, 1978:61).

It is within this scenario that models as a teaching aid suggest themselves as a way of improving understanding and ultimately the image of the discipline. These range from three-dimensional models to abstract symbolic models.

## 2.5 Models

The word model in the abstract sense has varied meanings but tends to be restricted in its uses to "invented ideas" which attempt to explain why aspects of the physical, natural and man-made behave as they do.

According to Harvey (1969) defining a model is extremely difficult due to the numerous functions models perform in research. A model can be a theory, it can be a law, it can be a structured idea, it can be a role or a relation. Ideally, however, a model should possess all of these qualities (Chorley and Hagget, 1967). According to Ackoff, "scientific models are utilised to accumulate and relate the knowledge we have about different aspects of reality and more than this to serve as instruments for explaining the past and present and for predicting and controlling the future" (Harvey, 1969: 13). Chorley and

Hagget state that models are "simplified structuring of reality which presents supposedly significant features or relationships in a generalised form" (Chorley and Hagget, 1967:22).

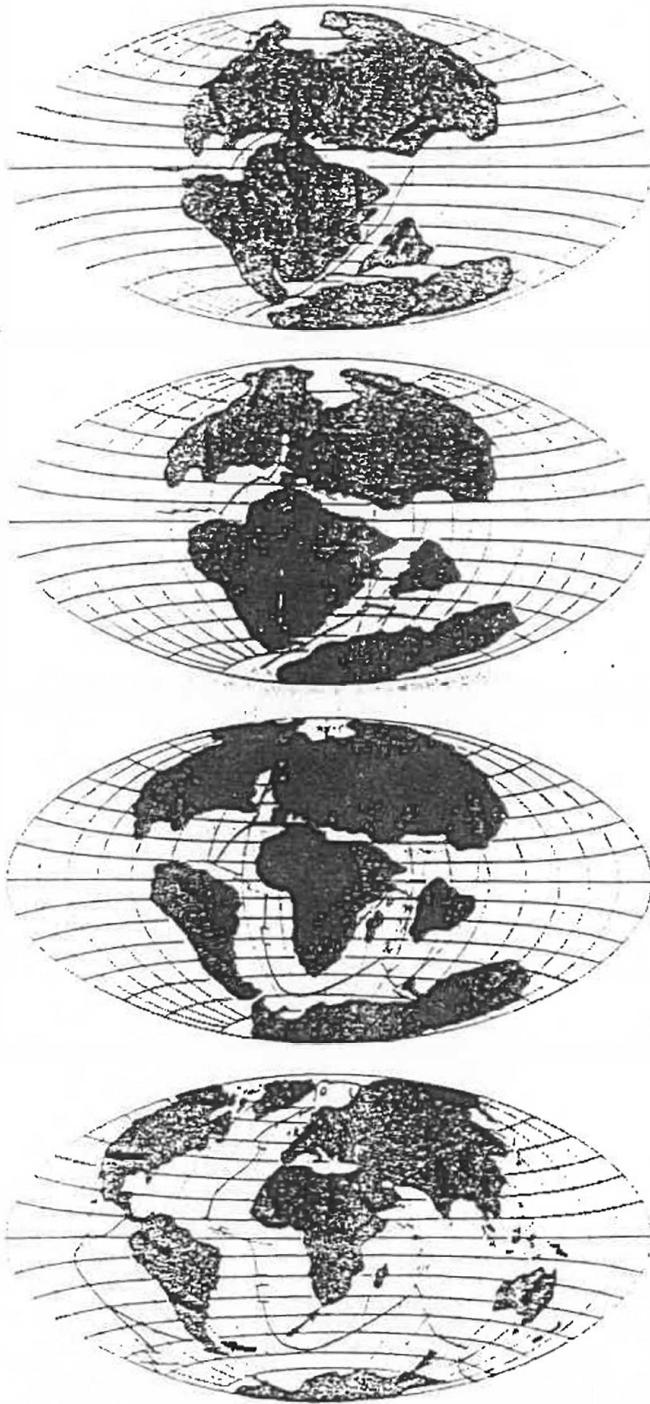
Several typologies of models have been devised, ranging from the more elaborate ones proposed for scientific research by Chorley and Hagget to simpler ones like those proposed by Ackoff. Ackoff states that models can be classified into iconic (where properties remaining the same are represented at different scales), analogue (where properties are represented by other properties), and symbolic (where properties are represented by symbols). There are several examples of these models used in school textbooks. For instance, pictorial diagrams or 3-dimensional geomorphological diagrams are examples of iconic models, Burgess and Christaller's models are symbolic, and the common 2-dimensional maps are examples of analogue models.

## **2.6 Functions of Models**

According to McElroy (1984) models are made necessary by the remoteness or inaccessibility of the real subject of study and complexities of the real world (McElroy, 1984). They are deliberately constructed to represent one view and ignore the others. Figure 2.1 overleaf represents how models simplify reality for easier understanding. For example, the theory of continental drift is an abstract, complex, remote and inaccessible process but it is represented and made simple in the figure.

Kac suggests that "models in science are for the most part caricatures of reality, but if they are good, then like good caricatures they portray, though perhaps in a distorted manner some of the features of the real world" (Osborne and Gilbert, 1981:58). Ball

Figure 2.1: The Development of the Continents



Source: Earle, J.L et al., (1985) New Window on the World Standard 8, Juta and Co., Kenwyn.

distinguishes between substantive models which "describe, classify and predict to a varying degree how a body of content functions" and instructional models which "translates content into effective learning activities it incorporates all the components of the teaching - learning process" (Ball [ed], 1971: 173).

One danger in using models is the failure to make students aware of the degree of abstraction, generalisation and scale involved in a model (McElroy, 1984). According to Kirby (1981) models simplify in order to aid understanding but increase the problem of relating the abstract back to reality. Chorley and Hagget (1970:367) state that "Geographers have been loathe to make use of models which stems from a misconception of the nature of models wherein they are expected to be true or real or to possess other equally equivocal qualities". In this respect, models are to be viewed as subjective frameworks constructed for specific purposes, relating to a limited range of reality and only relevant within well-defined levels of information content, sophistication and time and therefore not one to be expected of accommodating many aspects of reality (Chorley and Hagget, 1970).

## **2.7 Educational Value of Models**

In the quantitative revolution of the 1960s, the introduction of models was not well received by teachers. Some teachers in Britain actually viewed them as significant only for academic geographers.

As far as school teaching was concerned, models were viewed as "blind alleys" which teachers were urged to shy away from (Walford, 1973:99). It is for this reason that

models were said to being jargon-riddled, complex or too mathematical. In science teaching Osborne and Gilbert note what they call a "downward pressure of sophisticated examples and classes from research through undergraduate teaching to school-level ," adding that "Few models seem to be developed primarily as heuristic devices for school level work" (1981:61).

It is apparent that many teachers find it difficult to follow the type of theoretical reasoning which governs the logical development of models (Hall, 1976). For instance, they find it difficult to conceptualise Christaller's isotropic surface, a demand curve, or how regularly spaced settlements could arise without specific site controls (Hall, 1976). This is because teachers often seek specific reasons for particular cases (Hall, 1976).

In schools, models for Geography education are not intended to be used for making predictions but with the purpose of learning about and have a better understanding of the environment. Models have become indispensable tools to the teaching/learning situation because of their simplicity.

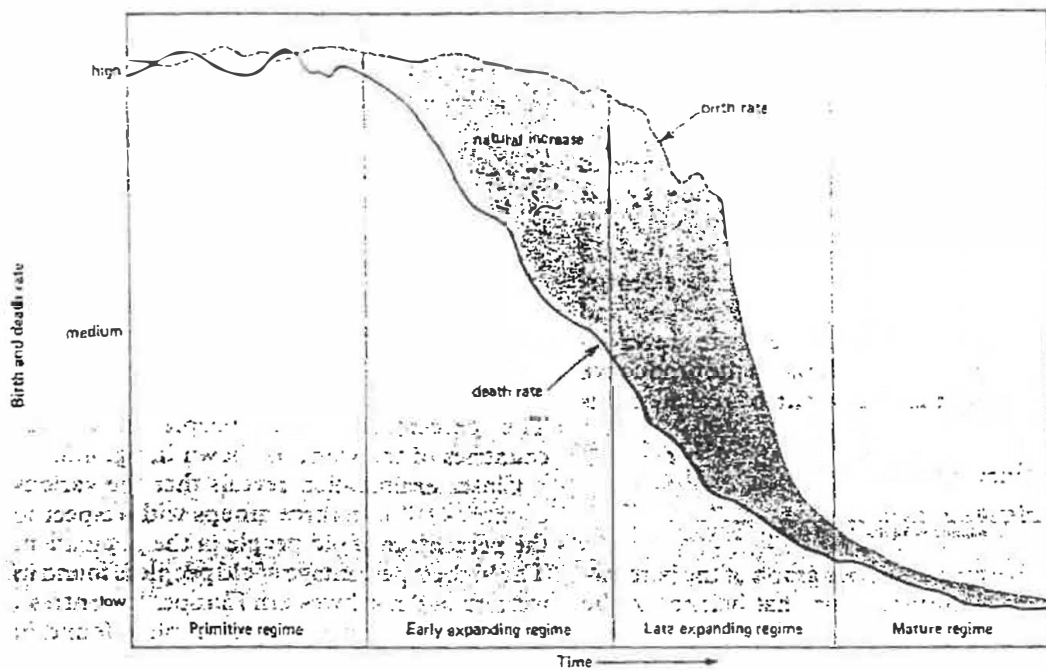
Reality is multivariate and too complex to comprehend and educationists have, therefore, devised models to simplify reality for easier understanding. Chorley and Hagget view models as "selective approximations, which by the elimination of incidental detail, allow fundamental, relevant or interesting aspects of the real world to appear in some generalised form" (Chorley and Hagget, 1967:25). This is an important feature of models, their selectivity, ignoring certain aspects of the complex reality and retaining and

representing only the relevant and important ones and that is where the teaching strength of models lies.

Another reason why models have become such valuable paths to understanding is because, as noted by McElroy, there is "the remoteness or inaccessibility of the real subject of study, they allow an investigation of the abstract, remote and unobservable" (McElroy, 1984, p. 133). They also act as psychological devices enabling complex interactions to be easily visualised (Harvey, 1969: 99). In this way they act "as a guide to the reality not readily seen ..." (Walford, 1973:99). In this way they act as valuable paths to understanding of what is not observable. Indeed models should be "applied to certain areas of the real world and certain patterns become apparent" (Hall, 1976:177). It is in these respects that models are sometimes referred to as structured vehicles, organisational devices and systems (Schamp, 1990; Walford, 1973; and Chorley and Hagget, 1967).

Models do not express single facts but enable two or more concepts to be related, with the purpose of providing general arrangements of phenomena in the environment (Dunlop, 1976; Slater, 1982). Figure 2.2 illustrates this by relating birth rate to death rate. Presenting reality in a structured form "leads one to comprehend, ... more than might be from information presented piecemeal and at most, to apprehend general principles which may have wider application than merely the information from which they are derived" (Chorley and Hagget, 1965:366). "They [also] provide mental structures which pupils as they move up through the school, should be able to recognise at different levels of complexity" (Dunlop, 1976:24).

Figure 2.2 : The Four Stages of the Demographic Cycle.



Source: Swavevelder, C.J. et al., (1985) Senior Geography Standard 8, Nason Limited, Cape Town, (p. 139).

In fact models "are useful as a teaching device because they generalise experience in a form which can be learned easily and economically" (Hall, 1976, p. 113). Lastly, models assist in concept understanding (McElroy, 1984).

Models should not be used in isolation, instead they should be integrated with fieldwork to serve as stimuli to reason about the real world (Fien et al., 1984; Chorley and Hagget, 1970). Models such as those of urban structures can be a useful tool in helping children understand their local town. And moreover, this could help them build a model of their own town. Treating models in isolation sometimes also results in rote memorisation of the model without an understanding of the underlying concept. In using models it ought to be recognised that they are models of something else and thus have little value in themselves.

## **2.8 Research into the Use of Models**

Due to the variety of models that are possible to make, research into their use has concentrated on specific models rather than on all models. Such specific studies include the pictorial depth perception studies by Osborne and Gilbert, 1981; Koch, 1954; Hilary, Campbell and Brown, 1988 and McElroy, 1984; cultural suitability studies of illustration as by Mayer, (1989) and the use of different softwares, the models they generate and subsequent tests of these models (Unwin, 1981; Schamp, 1990). Results from these studies acknowledge that the understanding of models is related to the level of one's cognitive development. This is in agreement to the conclusions from the learning theories reviewed earlier on.

Clark (1990) identifies two distinct cognitive processes involved in the interpretation of instructional diagrams. Firstly, the child has to break down the different variables in order to understand them. Secondly, this must be followed by "simultaneous or holistic processing of all the features at once and their encoding in memory as spatial configurations of images" (Clark, 1990, p. 3).

## **2.9 Models Used in School Textbooks in the Transkei**

To meet the requirements of the Transkei Secondary School syllabus and to bring more clarity and simplicity to the content, textbooks used in schools are full of models in schematic, geomorphological, outlines or graphical forms (Earle, et. al. 1989; Warwick, 1987).

The range of models used also range from real world pictorial diagrams to symbolic non-pictorial diagrams. These are expressed in various forms, for instance, in the form of graphs, in words, as systems diagrams, as schematic diagrams, schematic outlines. These differences also appear in the range of models used in the systematic branches of Geography.

The range of models used in Climatology include the over-simplified global models of primary circulation of the atmosphere and pressure belts. These are supplemented by models of the more complex processes in the atmosphere such as the Hadley cell, seasonal migration of the atmospheric pressure and wind belts. Models of a more local scale are also found such as the thunderstorm model and the urban heat island. Other

diagrams such as block diagrams graphs, and isobars are used to bring the 3rd dimension into the processes of the atmosphere.

Models in Geomorphology range from the more global ones like the internal structure of the earth, plate-tectonics and continental drift. Models of landform development exist in examples such as the Raisz fluvial cycle, Davis cycle, King's cycle etc. Simple landform models in the form of block diagrams also exist. Ecosystems models integrating physical and human aspects are only introduced in Standard 10.

In Population Geography, models are introduced in Standard 8 and include such models as those of the demographic transition and population pyramids. Models in settlement geography are introduced early in Standard 7 and revisited in Standard 10.

Models such as those of urban structure and the models of central place hierarchies are examples of these models. Examples of models in Economic Geography include models of industrial location and the models of economic development.

In general there are more models on Physical Geography in the Geography textbooks used in the Transkeian schools than in Human Geography. The reason for this may be because while Physical Geography is introduced to pupils from primary school without a break to the senior secondary school, parts of the Human Geography course are introduced at specific levels only. For example, Population Geography is only introduced to pupils in Standard 8.

## 2.10 Variables Selected and their Justification

From the review presented above, it can be concluded that a study of learning abilities, as with all human competencies, naturally falls into three parts, a study of environmental factors, a study of genetic factors and a study of the interaction between the two over time. Both environmental and genetic components are associated with a large number of factors. Selection of variables for this study acknowledges this and gives it the attention it deserves. While this study places more emphasis on school environmental conditions some amount of time is spent in assessing the effect of the other factors. However, it is neither practical nor helpful for one to attempt a study of the whole range of factors. It seems reasonable, therefore, that certain factors be selected which are relevant for the study and important within the context of the sample used.

It has been noted that the nature and purpose of scientific enquiries depend largely on several theoretical and conceptual frameworks which help in the clarification and simplification of descriptions and explanations of the various phenomena (Abler, Adams and Gould, 1972). Apart from helping to introduce order and better understanding in descriptions and explanations of existing situations, theories and concepts also help in the process of plan formulation. In a study such as this one therefore, a theoretical conception provides a proper framework within which to select certain variables.

First and foremost, therefore, the variables selected for this study were guided by theoretical considerations. Another important consideration was that the variables should as far as possible cover the two viewpoints ie nature and nurture and their time element.

The selected variables should also be meaningful within the general body of literature on learning abilities bearing in mind the characteristics of Geography education in the Transkei and the pupils who will form the sample. A final consideration relates to the views of Knox that such variables should possess such qualities as to allow them to "... be categorised along a continuum from good, to bad; high to low in relation to the concept being measured" (Knox, 1978:79).

Bearing in mind the above considerations and the objectives of this study, twelve variables of a demographic nature were selected for this study. The changes in these variables formed the framework within which the data would be examined. These variables appear as section One of the questionnaire (Appendix A).

## **SUMMARY**

The review of the concepts and theories relevant to this research has brought to light the following conclusions:

1. Learning abilities are multifactorially determined, involving over time, both environmental and genetic factors.
2. Environmental factors mostly relate to family background factors and school practices.
3. Age is related to the state of readiness with which an individual will acquire the ability to learn certain concepts.
4. Geography education in the Transkei suffers from a host of factors some of which can be helped by putting more emphasis on the proper use of models.

5. Theoretical models do help in the understanding of reality in teaching geographical concepts.
6. There are more physical than human geography models in the Geography textbooks used in the Transkei.

## *CHAPTER THREE*

# **RESEARCH DESIGN AND METHODOLOGY**

### **3.1 Introduction**

This chapter outlines the research design and justifies the use of methods utilised in the collection and the analysis of the data. The following procedures were utilised in the collection of the information for this thesis.

### **3.2 Data Gathering: Types, Techniques and Sources**

Two main types and sources of data collection were employed to fulfil out the objectives of this study. These are primary data collection and secondary data collection. The information collected through these two methods of data collection is related to the following information:

- (a) procedure to be followed in the use of the measuring instruments.
- (b) selection of subjects.
- (c) secondary sources of data.
- (d) analysis of data.

### **3.3 Primary Data Acquisition**

In terms of the objectives of this research, data collection was primarily related to the following:

- (1) the selection of instruments to measure the level of understanding of models by pupils;
- (2) the selection of techniques to assess the way models are used by teachers;
- (3) the selection of teachers and pupils for the sample population;
- (4) the selection of techniques which help to identify within and between group differences;
- (5) the selection of techniques which help to identify the main problems of understanding with the use of models by pupils studying Geography in the Transkei.

### **3.4 Selection of Instruments to Measure Pupils' Understanding of Models Used in Geography Textbooks in Transkei**

Models are important not only as teaching/learning aids in many classrooms but as a part of the everyday lives of children and adults alike. In selecting instruments to measure pupils understanding of models attention was paid to three aspects of learning: what the child knows, how this relates to a framework of knowledge, and how children learn (Carrol, 1963). There is evidence indicating that it is inappropriate to select pupils' tasks only by age.

Three widely used methods for the investigation of problems connected with the use of models are: the use of tests or examinations, the experimental method involving the use of lesson units and the interview method. In view of problems of communication, and

interpretation (such as translation of responses), coupled with the lack of the necessary resources, the use of interviews and the experimental method were discarded in this research. Tests were decided upon as being the best instrument within the constraints of time and resources. The questions used in the test (Appendix B) were selected from each of the different groups of models described in Chapter Two (p. 33-34). However, the questions only elicited simple answers designed for the sole purpose of testing understanding.

Besides these questions, pupils were asked to assess their attitude to each model on a five-point Likert-type scale. The Likert scale is a five point scale that is designed to measure a person's response to an object or a situation. Essentially the Likert scale offers a choice of attitudes to an object along a continuum. The technique is advantageous because it offers both associational and scaling properties (Moser and Scott, 1961). While research in education has tended to concentrate on the use of the Likert scale, this is not necessarily the most established approach (Moser and Scott, 1961). The Likert scale is easier to use because its design makes it readily understood (McCallon and Brown, 1971).

The use of the Likert scale involves the use of questionnaires. Accordingly, the primary data for this research was gathered through questionnaires. Despite the complexities and limitations of using questionnaires, such as problems with levels of literacy and the lack of freedom in the choice of answers, this was decided upon as the best means of gathering the required data with regard to the instruments selected (Cohen and Manion, 1984).

The first section of the questionnaire identifies details pertaining to the characteristics of the survey population and also identifies pupils' backgrounds in Geography (such as length of time spent studying the subject). This section - comprising twelve items - also includes questions demanding responses of either a Yes or No or a True or False type of answer. The purpose of this section is essentially two-fold. By identifying the personality factors that reflect in the differences in the levels of understanding of models new knowledge will be developed. Secondly it can point to directions for research.

The last section of the questionnaire consists of eight items which are statements concerning attitudes to models in Geography. In this section, pupils were presented with sets of statements about how they viewed models in Geography, ranging from those that were positive in tone to those which were negative (Gilbert, 1991). The statements were researcher-designed items to which the pupils responded.

The focus of the study was on 341 standard eight and nine pupils of selected secondary schools in the Butterworth district of the Republic of Transkei as it was at the time. The sample was drawn in such a way that it contained all ability groups, both boys and girls and spanned the various age groups.

### **3.5 Attitudes to Models by Geography Teachers in the Transkei**

Questionnaires were used to assess the attitudes of teachers to models and how often they used them. The questionnaires for teachers was divided into three parts. The first part requested information on personal details including such items as sex, qualifications, teaching experience, and so on.

The second part of the questionnaire requested information on the models appearing in the textbooks they use. The information ranged from problems they and their pupils faced with models and how often they employed the models for teaching purposes. The final section (Section C) of the questionnaire however sought their perceptions of the models used using a Likert-type scale. This final section was intended to see if there were any correlations between perceptions of teachers and their teaching practices.

The content of the questionnaire as a whole was arranged around certain themes to reflect the major research areas. These involved the selected models. The main areas of concentration were:

- (1) understanding
- (2) interest
- (3) attitudes to the models used in school textbooks
- (4) perceived relevance of models.

### **3.6 Research Location**

The research was conducted among 341 standard nine and eight pupils of four schools in the Butterworth district. Research such as this should ideally have been conducted among all the secondary schools in the Transkei. Such an approach is, however, fraught with serious difficulties among which can be mentioned financial and other logistical constraints. Factors in favour of Butterworth, as noted earlier in Chapter One, include its rural and urban component which is "representative" of the country, a long history of education leading to a satisfactory teacher base, and the personal experience and participation of the researcher in Geography education in the district.

### 3.7 Selection of a Sample

Strict adherence to the tenets of research would necessarily require all school pupils as subjects in this research. The imminence of time, material and financial constraints, however, have compelled the researcher to limit the study to a small sample of secondary school students. The study was limited, primarily, to 341 standard eight and nine secondary school pupils drawn randomly from four senior secondary schools in the Butterworth District of the Transkei. Several reasons guided the selection of the high school students for this study.

The study was limited to the high school pupils partly because senior secondary school, while linked to the others, has its own identity and purpose. It deals with young people from age fifteen onwards. These are a group of students who are, as in most parts of Africa:

"... at the stage at which dissatisfaction with the education pupils have been receiving makes itself felt, grievances become built up in their minds; there appears to be little or no redress through the authorities and so alienation and mindless violence takes place". (Taylor Commission, 1979:101).

A student from a high school may enter the University if he has the required grades. The student might graduate from there with a degree which will entitle him to a decent job. Those unable to pass so well may enter training colleges to qualify as teachers. On the other hand those who fail may enter the job market where they may be required to wait two or more years before getting a job (Wakelin, 1985). Even when the latter are lucky enough to get one, the salary attached is normally very low and consequently their standard of living is very low.

As noted earlier on in Chapter One, the high school career introduces profound differences in the standard of living among people. The high school course is, therefore, of considerable importance to a student's future standard of living. High school children are more likely to suffer as a consequence of poor academic achievement than those at any other stage of the educational ladder.

Sometimes poor economic circumstances may prevent one from continuing his/her high school studies. Since many of such students are at an age where they can enter the labour market, many thus leave school to work. It is not surprising, therefore, that drop-out rates are much higher in the high school than at any other step of the educational ladder as indicated in the table 3.1.

**TABLE 3.1 : NUMBER OF SCHOOLS, SCHOOL-GOING POPULATION AND NUMBER OF TEACHERS IN TRANSKEI - 1992**

TYPE OF SCHOOL	NUMBER OF SCHOOLS	NUMBER OF PUPILS	MALE TEACHER	FEMALE TEACHER
JUNIOR PRIMARY	441	505 843	72	6 451
SENIOR PRIMARY	959	281 040	753	4 874
JUNIOR SECONDARY	1 585	155 356	3 539	4 511
SENIOR SECONDARY	247	72 403	1 451	1 387
TEACHER TRAIN'NG COLLEGE	12	5 261	126	122
VOCATIONAL/TECHNICAL	8	2 443	97	59
SPECIAL SCHOOL	5	602	8	55
SPECIAL COLLEGE	1	265	15	7
<b>TOTAL</b>	<b>3 258</b>	<b>1 023 213</b>	<b>6 061</b>	<b>17 466</b>

Source: Annual Report, Department of Education, Transkei, 1992

Looking at the numbers at each level, it can be noted that the largest number of pupils is at junior primary, that is, children who are just starting school. However, looking down the column towards the senior secondary level, the numbers drop sharply. In fact this table shows the school enrolments, it does not consider those children who do not go to school at all.

It is noted, for instance that, in the Transkei, only 36% of those in standard eight carry on to standard nine with a further 38% of those pupils dropping at the end of that standard. From the review presented it is evident that high school pupils in these standards (eight and nine) present a special case in studies of academic achievement.

First year senior secondary pupils were included in this research also because the influence of different home environmental conditions on the individual at this stage is often strong. Pupils in standard eight of a senior secondary school are also more aware of what academic achievement means to them. Indeed in the first year of a senior secondary school in the Transkei, it is possible to find many pupils who have gone to work for many years after standard seven before coming back to school. Motivation is therefore very high. It is possible at this stage to gauge the influence of one's home conditions on his performance at school and thus examine the impact of nature or nurture in academic achievement. In the first year of Transkeian senior secondary schools too, the ratio of male to female pupils very nearly reflect the sex ratio of the general population so that the sample size drawn can be a mirror of the general population.

The formative years in senior secondary studies (ie standard eight and nine) have also often been noted to be of great importance to the life of a child (Duckworth and Entwistle, 1974). It may either encourage development through presenting challenge and stimulation or have a detrimental effect (Finlayson and Cohen, 1967; Evans, 1987; Chitensen and Massey, 1989). It seems, therefore, that it is a critical stage in education and thus deserving of a focus in assessing the level of understanding of models. One other reason for focussing on standard nine pupils in this research is to compare the role of models in learning among pupils after they have had a year in high school. Standard nine pupils were also deemed to be of sufficient maturity to reflect the views of pupils who had enjoyed a considerable period of time in a high school. One other reason made it difficult to include standard ten pupils. This was due to the fact that at the time of the research (March 1992), it was discovered that admissions to the standard ten class in the selected schools, of students who had failed their matric the previous year, was still going on and it was therefore difficult to establish a representative group of a class that was constantly changing.

To ensure objectivity in the selection of the schools and at the same time ensure that variations in the school population were accounted for, multi-stage cluster sampling involving the grouping of the population and the selection of respondents from each group was utilised. All the senior secondary schools in the Butterworth District were arranged into two groups: rural and urban schools and listed alphabetically.

Table 3.2 lists the senior secondary schools within the Butterworth District, their locations and the number of pupils in them.

Two schools were selected from each group using a table of random numbers. In each school pupils were selected from the academic reports of the class teacher. The selected schools and the proportion of pupils from each is listed on Table 3.3.

TABLE 3.2 : LOCATIONS OF SENIOR SECONDARY SCHOOLS IN BUTTERWORTH DISTRICT AND THEIR POPULATION

SCHOOL	LOCATION RURAL/URBAN	NUMBER OF PUPILS
BETHEL	RURAL	150
CUNNINGHAM	RURAL	494
DALUHLANGA	RURAL	123
ELUKHANYISWEN	RURAL	135
LAMPLOUGH	URBAN	601
MSOBOMVU	URBAN	621
MTEBELE	RURAL	399
TEKO	RURAL	282
VULLI VALLEY	URBAN	380
VULUHLANGA	RURAL	281
ZWELANDILE	RURAL	117
<b>TOTAL</b>		<b>3 583</b>

Source: Circuit Office, Dept of Education, Butterworth.

(Rural refers to locations outside Butterworth, while urban refers to locations in Butterworth).

**TABLE 3.3 : SELECTED SCHOOLS**

SCHOOL	LOCATION	NUMBER OF RESPONDENTS	CLASS
LAMPLOUGH	URBAN	48	STD 8
LAMPLOUGH	URBAN	49	STD 9
MTEBELE	RURAL	56	STD 8
MTEBELE	RURAL	43	STD 9
VULLI VALLEY	URBAN	48	STD 8
VULLI VALLEY	URBAN	38	STD 9
ZWELANDILE	RURAL	56	STD 8
ZWELANDILE	RURAL	29	STD 9
<b>TOTAL</b>		<b>341</b>	

Source: Field Survey, 1992

The sample size thus formed roughly 10% of the senior secondary school population in the Butterworth district. The survey sample was drawn so as to reflect the differences in the population in terms of certain characteristics (for instance 64% of the respondents were selected from the rural areas because of the higher population in those areas). Some of the demographic characteristics of the sample used are summarised in Tables 3.4 - 3.6 below.

**TABLE 3.4 : PERCENTAGE DISTRIBUTION OF THE SAMPLE BY GENDER**

GENDER	PERCENTAGE
FEMALES	66%
MALES	34%

Source: Field Survey, 1992

**TABLE 3.5 : AGE DISTRIBUTION OF THE SAMPLE**

AGE	NUMBER OF RESPONDENTS
<= 13	10
14	44
15	61
16	84
17	60
18	44
19	22
20+	16

Source : Field Survey, 1992

**TABLE 3.6 : PERCENTAGE DISTRIBUTION OF RESPONDENTS BY LOCATION**

AREA	PERCENTAGE
RURAL	64%
URBAN	36%

Source : Field Survey, 1992

As indicated in Table 3.4, 34% of the sample drawn were males and the remainder females. The pupils ranged in age from 12 years to over 20 (Table 3.5). They had all been studying Geography for at least one year. One hundred and fifty seven of the respondents came from the rural area while seventy six came from the urban area.

### **3.8 Administration of the Questionnaire**

The questionnaire was initially administered to twenty pupils (ten from a rural school and ten from an urban school). The purpose of this technique was to gauge the understanding of the items proposed. From the results of this pilot survey the final draft

of the questionnaire was prepared after the wording of some of the items was modified to clarify their meaning.

The questionnaires were personally administered by the researcher to avoid any problems relating to postal surveys such as delays and low return of responses (Cohen and Manion, 1988). In each school, however, the class teacher's help was enlisted to ensure that an atmosphere was created that was conducive for conducting a test and completing the questionnaires. Pupils were asked not to identify themselves in an attempt to encourage truthfulness in the completion of the questionnaire. Where an individual failed for one reason or another to answer a certain question the individual's total data set was rejected to avoid any bias through selectivity. For this reason of the 400 questionnaires distributed only 341 questionnaires were found suitable for the analysis.

Thirty Geography teachers were selected from the schools where the research took place and also from the other schools within the district. The thirty teachers were made up of 10 (about 33%) males and 20 females (about 67%). Twenty of the teachers were selected from rural schools while the rest came from urban schools. Twelve of the teachers were selected from the schools visited and the rest were picked at random.

### **3.9 Validity and Reliability of the Data**

One of the major problems with research of this kind is the validity of the data gathered. Validity in this sense is held to mean the avoidance of bias (Cohen and Manion, 1984). Measures taken to reduce bias in this research included making the meaning of the questionnaires used very clear as a result of corrections made after the pilot survey,

varying the content of the questions used to increase interest among a wide variety of pupils, not allowing pupils to communicate with each other while completing the questionnaires and also the use of probability sampling in the selection of the sample. The use of questionnaires also encouraged honesty because they were anonymous.

Reliability of the data on the other hand refers to the consistency of the answers given (Mahilangu, 1987). One of the measures taken to ensure reliability in this research was to vary the questions in such a way that more often than not one question often acted as a check on the other. This allowed the answers given to be cross-checked.

### **3.10 Supplementary Data Acquisition**

In addition to the data obtained from the field, information was also obtained from the records of the Regional and District Offices of the Department of Education in Butterworth, and from the Head Office of the Department in Umtata. A lot of valuable data was also obtained from books, journals, pamphlets, and from periodic reports of various governments departments.

### **3.11 Data Analysis**

The analysis of the data was carried out in order to allow for hypothesis testing. The null hypothesis used stated that the distribution of group responses to each individual item would be identical. The alternative hypothesis would, therefore, imply that the distribution of group responses to items in the questions indicate shifts in the response locations.

In testing this hypothesis the following procedures were followed:

- A. Group analysis: summarising each group of responses to provide a simplified picture of the situation. The response for each individual was obtained and so was their performance in the test. This score was assumed to be an indication of the individual's level of understanding of the model (Cohen, 1968). To allow the assessment of the responses to be placed in a proper perspective, the analysis was first limited to the total score on the test on each of the models.
- B. Within group analysis: the performance of the pupils was then assessed in groups as for sex, family background, etc. The expressed attitudes to the different models by the different population groups (e.g. males) were also summarised by assessing:
- (1) the relative popularity of each attitude of the scale for a designated group as shown by the frequency distribution for that group
  - (2) the range of opinions accepted or rejected
  - (3) the degree of homogeneity in the attitudes of a designated group to a particular attitudinal statement as shown by the spread or dispersion of its frequency distribution.

To enable group differences (as in sex) to be tested for significance, the chi-square test is utilised. It is used when comparing the number of groups falling into a certain descriptive category. While it is often used to distinguish between two categories, it can also be used to categorise three or more groups. The chi-square test compares the observed to the theoretical frequency and answers the question of whether the differences could be ascribed to chance. Its basic principles are:

- (a) that there is a theory or an idea of a certain kind about how the cases should be distributed;
- (b) that there is a sample showing how the cases are actually distributed;
- (c) there is a wish to know whether or not the differences between the theoretical and the observed frequencies are of such size that these differences might reasonably be ascribed to the operation of chance.

The chi-square is simple, and easy to use. A 95% level of significance is the minimally accepted level in using the chi-square test. Differences are also considered only if the P-value is <0.05. At this level, the null hypothesis (Ho), which asserts the independence of the groups, is rejected and then the alternative hypothesis (Hi), which holds that the variables are dependent, is accepted.

C. Underlying trends: the scores from the 341 returns were also correlated with the personality factors (section one of the questionnaire) and placed in a hierarchical cluster to identify groups of items which - taken together - might reflect some underlying positions. The product moment correlation examines bi-variate relationships especially the degree of linear association between a pair of variables. It is expressed as the ratio of the covariance to the square root of the product of their variances as shown by the formula below:

$$r = \frac{\sum ab - \sum a \sum b}{\sqrt{(\sum a^2 - (\sum a)^2)(\sum b^2 - (\sum b)^2)}}$$

where: Rab the correlation coefficient of the ath and the bth variables.

The correlation co-efficient varies from +1.0 indicating a perfect positive correlation, through 0 for no relationship to -1.0 indicating a perfect negative relationship. In between the ranges are various co-efficients indicating various degrees of relationships. Correlations are however statistically significant at a level of probability which must not be greater than 0.05 (Gosling, 1967).

One useful feature of correlation analysis is that the correlation co-efficients can be shown in a correlation matrix so that the largest coefficients can be identified. The correlation matrix of the selected variables and the demonstrated level of understanding of the models will indicate the strength and direction of relationship between level of understanding of models and the variables. This technique is referred to as cluster analysis (Bailey, 1973). There are many versions of such cluster analyses (Jardine and Sibson, 1971; Sneath and Sokal, 1973). The simplest of these is the Mcquitty's elementary linkage analysis which will be used in this research (Bailey, 1982).

To help identify the particular group of factors associated with variations in the performance of the pupils, and to reduce data overload factor analysis was employed in this research to measure the contribution of each factor.

Factor analysis can be employed in a number of research strategies. It can be employed to test or evaluate hypotheses deduced from a theory (Bailey, 1973); to transform a set of variables to a new set of orthogonal factors for input into a regression model (Moser and Scott, 1961); to explore the underlying structure into a data matrix (Gould, 1964); and to achieve parsimony in data description (Moser and Scott, 1961). In this research,

factor analysis will help to group the variables which will make description easier (parsimony) and also facilitate the identification of the factors associated with differences in the level of understanding of the models among pupils in the Transkei easier. Through factor analysis, it is intended in this research, to reduce the variables in the data matrix to a form that reflects the general pattern characteristic of the variables. Apart from providing information on the individual variables as they relate to their means and standard deviations, the relationships between the variables are also portrayed through their correlations. In factor analysis only the estimated variance - the portion of the variance in each variable which is related to that in other variables analysed - is subjected to scrutiny. The common variance represents common elements running through the data resulting in high correlations.

In addition to the methods outlined above frequencies: means, percentages and other statistical measures of centrality and dispersion (eg means) are employed at various stages of the research to enable descriptions and explanations.

### **3.12 Limitations of the Research**

This research is likely to suffer the following limitations:

1. The study assessed the views of only 341 pupils. This raises questions about the generality of the results. While time and cost constraints were the main considerations in the selection of this sample size, it severely limits the wider applicability of the results. For instance, the conclusions cannot be construed to mean that it has perfect validity for the rest of the population. The sample size is also not enough to properly assess differences between different types of

schools, socio-economic conditions and the backgrounds of pupils.

2. While the study attempted to probe the attitudes of Geography teachers to the use of models no attempt was made to probe their personality nor school organisation. It was accepted that this fell outside the scope of this research. However, if interviews had been conducted among teachers, it probably would have provided some information about personalities, school organisation as regards how these affect the availability and use of models.
3. The mere expression of an attitude also does not mean that one will act in accordance with it. Therefore, it is possible that replication of this research among the same respondents might produce different results.
4. The presence of the subject teacher and of the researcher is likely to have influenced pupil performance.
5. Data for this study was collected during the first week of March, 1992. At that time most pupils were just about settling into their high school work. Performance could therefore be affected by the fact that they had done very little of their senior secondary school work at that stage. Time constraints made it impossible to find a more suitable time.

6. This research investigated the problems of conceptual understanding of models used in Geography textbooks in the former Transkei. No attempt was made to investigate problems of understanding in other areas of the school curriculum. However, it is possible that any of these limitations may influence pupils' judgement or performance in either way. Notwithstanding these limitations, this study attempts to be a pointer to an existing situation.

### **Summary**

From the review presented above, the following methods of data collection and analysis were identified as having been utilised in this research:

- (a) selection of a sample size based on multi-stage cluster sampling;
- (b) questionnaires to identify personality variables;
- (c) tests to gauge level of understanding;
- (d) application of statistical techniques of generality such as correlations and factor analysis to draw inferences.

In the chapters that follow, the various techniques of data analysis discussed above are employed at various sections to carry out the objectives of this research. In addition to these techniques various tables are used in various sections of this research to elucidate some of the explanations and descriptions.

## **CHAPTER FOUR**

# **LEVELS OF UNDERSTANDING OF MODELS**

### **4.1 Introduction**

In this chapter the results of the tests to gauge the level of understanding of models by pupils are presented. Relationships between the levels of understanding and other personality variables are measured and commented upon. In this way problems with the level of understanding are unearthed.

### **4.2 Test Scores**

The scores of the battery of tests to measure the level of understanding ranged from 17% through 40% to 86%. The mean of the scores was 43 with a standard deviation of 18. In general it was observed that students in the urban areas did better in the test of understanding of models than those in the rural areas. While the average score in the rural areas was 40%, that of the urban areas was 47%.

The problem is related in part to the supply of and quality of teachers in these schools. Most of the well qualified teachers prefer to teach in the urban areas. For instance, at the time of this research, one of the rural schools had not had an English teacher for the standard eight class since the beginning of the year. The results obtained are shown on Table 4.1.

These results formed the dependent measure of level of understanding of models. The figures presented below are a summary of the results of all the tests combined. However, there were distinct differences in the results relating to each particular test.

**TABLE 4.1 : RESULTS OF THE TEST OF LEVEL OF UNDERSTANDING**

SCORE (IN %)	FRE- QUENCY	SCORE (IN %)	FRE- QUENCY	SCORE (IN %)	FRE- QUENCY	SCORE (IN %)	FRE- QUENCY
17%	2	35%	4	49%	6	65%	6
21%	2	36%	4	50%	7	66%	5
23%	6	37%	12	51%	13	69%	8
24%	5	38%	12	52%	5	70%	2
25%	2	39%	10	53%	5	71%	5
26%	5	40%	11	54%	17	72%	5
27%	5	41%	8	55%	8	74%	2
28%	9	42%	4	56%	6	75%	7
29%	4	43%	3	57%	9	76%	2
30%	9	44%	3	58%	11	82%	2
31%	5	45%	13	60%	8		
32%	12	46%	6	61%	5		
33%	9	47%	2	62%	4		
34%	5	48%	9	64%	14		

Source: Field survey, 1992

### 4.3 Model One (Gravitational Pull)

The results of model one sought to establish the level of understanding of pictorial models among pupils. This consisted of diagrammatic representation of the gravitational pull of the earth.

The pull is illustrated by arrows with a series of frogs packed close to the earth's surface. The model comes from the standard eight textbook. There were ten one-mark questions in all with the best student securing a seven out of ten. The average in the test was four. Generally the female respondents with an average of six did better than their male counterparts with an average of three.

#### **4.4 Model Two (Urban Structure)**

The second model consisted of a diagrammatic representation of the models of urban structure from Burgess, Hoyt and Harris and Ullman. The model was selected from the range of models used in one of the standard seven textbooks. In this particular test the performance was very weak. The highest being five out of ten but most of the pupils scored below three. The average score was two.

#### **4.5 Model Three (Volcanic Structure)**

This is a model of intrusive volcanic landforms. It is rectangular in shape with the landforms shaded in a deep black. The model was selected from the range of models in the standard eight textbooks. For some reason which is not quite clear now, results in this test were one of the best. Most of the pupils got five and above with the highest being eight out of ten. The average was six.

#### **4.6 Model Four (Farming Systems)**

The model used in this test was selected from the standard seven textbook. It is a schematic diagram of a farm inputs and output variables. Its purpose is to illustrate the linkages between these items. Performance in this test was very poor. The average score was three even though one student secured a six out of ten.

#### **4.7 Model Five (Structure of the Atmosphere)**

The structure of the atmosphere formed the model used in the fifth test. This is a schematic diagram showing the various layers of the atmosphere and comes from the standard eight textbook. The model also illustrates the composition of the atmosphere, the temperature of each layer, and the approximate height of each layer. Performance in this test was also weak. While three of the students got all correct, the average score was only four.

#### **4.8 Model Six (Agricultural Systems)**

The questions for model eight were based on a pictorial model from the standard eight textbook on agricultural systems. It paints a picture of two systems: one from the poor underdeveloped countries and the other from the rich developed countries using a series of pictures. Performance in the test based on this model was also good - in fact it was the second best. The average score was six but quite a large number of students got eight out of ten.

#### **4.9 Model Seven (Demographic Transition)**

Questions for this were based on the model of demographic transition selected from the standard eight textbook. The model itself is a graphical representation of birth and death rates divided into stages. The performance in the test was very weak. The average score was two, with the highest being a five out of ten.

#### **4.10 Model Eight (Factors Influencing Death Rates)**

The questions for this test were based on a schematic model. This is a model illustrating the factors influencing the crude death rate. The model comes from the standard eight

textbook. The performance in this test was also poor. The average score was three and most of the students failed to answer all the questions.

#### 4.11 Section Nine

In this section pupils were made to explain certain words used with models in their textbooks. There were two marks awarded for each correct answer. The performance in this test was very poor. The average score was four out of twenty while the best score was eleven out of twenty.

The combined results of all the tests were used to gauge levels of understanding of the models used in the school textbooks. The test results were then correlated with the personality factors listed in Section A of the questionnaire. Only statistically significant differences are presented in the following section.

#### 4.12 Significant Differences

Significant differences were initially noted using the test scores as presented in Table 4.2 below.

**TABLE 4.2 : MEAN SCORES OF TESTS**

TEST ONE	40%
TEST TWO	25%
TEST THREE	60%
TEST FOUR	30%
TEST FIVE	40%
TEST SIX	60%
TEST SEVEN	25%
TEST EIGHT	30%
TEST NINE	40%

Source: Field Survey, 1992.

A comparison of the mean scores reveals that performance in the test was better where only pictorial models were used (tests three and six) than where schematic diagrams were used. This finding is consistent with those of Lindworsky (Chapter two) in that it emphasises the importance of visual representation in learning over abstractness. Pictorial models are visually easier to comprehend than schematic diagrams. While this may be an important realisation the models used in school textbooks in the Transkei have only a few pictorial diagrams as indicated in Table 4.3 below.

**TABLE 4.3 : MODELS USED IN THE PRESCRIBED GEOGRAPHY TEXTBOOKS IN THE TRANSKEI**

(These are: New Window on the World Series (NWOW) and the Senior Geography Series (SG)).

TYPE OF MODEL	TYPE OF BOOKS AND CLASS						TOTALS
	NWO STD 8	SG STD 8	NWOW STD 9	SG ST 9	NWOW STD 10	SG STD10	
GRAPHS	30	10	9	4	25	20	98
SCHEMATIC DIAGRAMS	44	23	101	78	151	84	481
SCHEMATIC OUTLINES	18	0	8	0	0	2	28
SYSTEM DIAGRAMS	5	0	0	2	19	8	34
3D DIAGRAMS	18	5	27	13	25	22	110
PICTORIAL	2	0	12	0	0	0	14
<b>TOTALS</b>	<b>117</b>	<b>38</b>	<b>157</b>	<b>97</b>	<b>220</b>	<b>136</b>	<b>765</b>

Source: New Window on the World Series, Senior Geography Series.

From the table it can be deduced that while pictorial models only constitute about 2% of all the models found in the two textbooks schematic diagrams constitute 63% of all the models. It is difficult to understand why schematic diagrams remain so popular inspite of evidence such as unearthed by this research.

## 4.13 Influences on Level of Understanding of Models

### 4.13.1 Watching Television and Level of Understanding of Models

In a discipline like Geography, where distant regions are often studied with no visual aids, television is valuable. In this study, therefore, it was not surprising that a number of significant differences were found in the level of understanding of those who watched television often and those who did not. In this connection Table 4.4 below summarises the responses to the frequency with which pupils watched television and their mean achievement score.

**TABLE 4.4 : PERCENTAGE DISTRIBUTION OF TELEVISION WATCHING**

FREQUENCY	PERCENTAGE	MEAN SCORE
REGULAR	28.1	41%
SOMETIMES	47.9	37%
SELDOM	9.9	32%
NEVER	14.1	22%
<b>TOTAL</b>	<b>100%</b>	

Source: Field Survey, 1992

From the above table, it can be deduced that the majority of the respondents only watched television sometimes. The correlation coefficient between T.V. viewing and level of understanding of models was a statistically significant .60 at .0003 level of significance.

The results indicate for instance that 56.9% of those who obtained 40 or more in the test were those who watched television often. Similarly 70.7% of those who never watched television obtained scores of 30 or below. Needless to say that this finding was but for a few differences the same for rural and urban children for the simple reason that many of those who never watch television are also resident in the rural areas.

#### 4.13.2 Listening to the Radio News and the Level of Understanding of Models

Access to the radio is another socio-economic index. Pupils from middle and high income families have more access to radios than those from low income families. Listening to the news on radio is considered to have educational value for Geography. The table below summarises the percentage distribution of the frequency with which respondents listened to the radio news and their score on the test of level of understanding of models.

TABLE 4.5 : FREQUENCY OF LISTENING TO THE RADIO NEWS

FREQUENCY	PERCENTAGE	MEAN SCORE
REGULAR	43.7	38%
SOMETIMES	47.4	44%
SELDOM	7.8	34%
NEVER	1.0	30%
<b>TOTAL</b>	<b>100%</b>	

Source: Field Survey, 1992

Examination of the data gathered reveals that there were significant differences in the answers provided by those who listened to the radio news and those who did not. The differences were also shown to be statistically significant with a correlation coefficient of .72 at 0.001 level of significance. Considering the visual effects of television it seems strange that the results seem to indicate that those who listened to the radio news seem to have done better than those who watched television. While this might seem so it must be noted that almost all those who watched television also listened to the radio news. It also seems plausible that some of the respondents might have answered the question to impress by indicating that they watched television.

Besides these significant differences, several other differences were noted in the overall performance of the test. One of these concerned gender.

#### **4.13.3 Gender and Level of Understanding of Models**

As indicated earlier on in Chapter Three, there were in the sample 225 (66%) females and 116 males (34%) reflecting the population composition of the schools in Transkei.

Upon the examination of the results it was observed that in both rural and urban areas, females did better than their male counterparts. The mean score of males in all the tests was 34%. Females had a mean score of 44%. Of those scoring fifty percent (50%) or more there were sixty-two (62) females - representing 21% of the total - and fifty one (51) males - representing 14% of the total number of students. In other words over 40% of the 225 females passed the test while only 35% of the 116 males passed. Indeed, the highest score of 86% was obtained by a girl. Rural females had a mean score of 39% while their male counterparts had a mean score of 37%. In the urban areas on the other hand, females had a mean score of 48% while males had a mean score of 41%. This would tend to indicate that urban males did better than rural females.

The Pearson's correlation co-efficient between sex ( $N = 341$ ) and level of understanding of models was 0.5772 at 0.029 level of significance. In effect this means that there is a positive relationship between sex and level of understanding of models. This relationship is also very highly significant. The results confirm the views of Archer (1976a), Goldberg (1970), Draper (1975) and Bem (1974) that there is a relationship between sex and academic achievement. The positiveness of the correlation confirms the views of Anastasi, (1958); and Coates, (1974) that a positive relationship exists between sex and academic achievement.

#### 4.13.4 Age and level of Understanding of Models

The second most important finding of the research after the previously acknowledged gender differences in the scores is the relationship between level of understanding of models and age. As a factor in learning age has been commented upon by researchers like Piaget. Experienced teachers for instance are aware that young children learn certain subject matter faster when combined with aspects of reality. The ages of the sampled students ranged from </13years (10%) through 17years (29%) to 27years (0.34%). The majority of them were however aged between 16 and 20 (74%). The age distribution of the respondents has already been given in Table 3.5 (Chapter Three) but it is presented again in an expanded form below as Table 4.6.

**TABLE 4.6 : AGES OF THE STUDENTS**

<b>AGE</b>	<b>FREQUENCY</b>
</= 13	10
14	44
15	61
16	84
17	60
18	44
19	22
20	6
23	3
24	2
25	2
26	2
27	1
<b>TOTAL</b>	<b>341</b>

Source: Field Survey. 1992.

While many of the younger students did very well in the tests to measure level of understanding of models the best student overall was aged 19 years. Of all those obtaining 50% or more in the test, 72% of them were aged between 17 and 20 years. The pattern was the same for both rural and urban areas. For each the mean score of the younger ones was much better than the older ones. The mean score of those aged between 17 and twenty for both rural and urban areas was 46%. However a few of some very old students did much better than their younger companions.

The correlation between age and academic achievement is  $-0.67$  at  $0.0001$  level of significance ( $N = 341$ ). This correlation is acceptable and it is also statistically significant (Bailey, 1982). In effect this means that performance improves with youth or that older students tended to understand models less than younger students.

There were differences in the degree of correlation between males and females when these are analysed separately. The correlation between the scores and female ages is  $-0.58$  at  $0.0001$  level of significance. For males the correlation was  $-0.45$  at  $0.02$  level of significance. The conclusion is thus that level of understanding of models is inversely related to age whether for males or for females. The correlation is however stronger in the case of females than males. The conclusion from this result is that females should be permitted to go to school earlier than males. Support for this contention also lies in the notion that is supported by many other studies that females mature on the average 2 years earlier than males. Several other researchers have discovered a relationship between age and academic achievement (cf Baltes & Schaie, 1976; Horn & Donaldson, 1976; Horn & Donaldson, 1977). From the findings presented there is conclusive evidence that age is related to level of understanding of models.

#### 4.13.5 Length of Time Studying Geography and Level of Understanding of Models

One of the most important conclusions of the research is the length of time studying Geography and its effect on the level of understanding of models. For many of the respondents their length of time studying Geography related to the length of time they have been in school. On the other hand a substantial number (26%) were starting Geography for the first time or only studied the discipline for the first time in standard seven. In Table 4.7 below the educational level at which respondents were introduced to Geography for the first time is shown.

**TABLE 4.7 : EDUCATIONAL LEVEL WHEN RESPONDENTS WERE EXPOSED TO GEOGRAPHY**

<b>NUMBER OF STUDENTS</b>	<b>EDUCATIONAL LEVEL</b>
187	PRIMARY SCHOOL
65	JUNIOR SEC. SCHOOL
52	STD 7 ONLY
37	STD 8 ONLY
<b>TOTAL 341</b>	

Source: Field Survey, 1992

The vast majority (76%) of those who got 50% or above in the tests have been studying Geography since the primary school. Of those who failed 38% had only been studying Geography since they entered senior secondary school. The outline presented above implies that level of understanding of models increases with the length of time studying Geography.

Correlations were computed between length of time studying Geography and the level of understanding of models. In this connection Table 4.8 summarises the length of time spent studying Geography.

**TABLE 4.8 : LENGTH OF TIME STUDYING GEOGRAPHY**

<b>NUMBER OF STUDENTS</b>	<b>LENGTH OF TIME</b>
187	8 YEARS
65	7 YEARS
52	6 YEARS
37	5 YEARS
<b>TOTAL 341</b>	

Source: Field Survey, 1992

The correlation between length of time studying Geography and the level of understanding of models was 0.7091 (N = 341) at 0.0001 level of significance. The correlation is statistically highly significant. The correlation implies that level of understanding of models increases with length of time studying Geography. What this means is that level of understanding of models decreases with a decrease in the length of time studying the discipline. The implication here is that pupils ought to be introduced to Geography more often perhaps through an increase in the number of periods allocated to the subject. Another implication of this finding is that pupils ought to be introduced to Geography education from a very early age. In most of the schools in the Transkei Geography is only introduced to pupils from Standard 4. In the years before this pupils are taught Geography as part of social studies education. This finding of the research tends to suggest that the current practice needs modification.

#### **4.13.6 Place of Residence and Level of Understanding of Models**

Overall urban residents did better than rural residents. The average performance of urban residents (36% of the sample) was 48% while that of rural residents (64% of the

respondents) was only 38%. The correlation between place of residence and level of understanding of models was 0.62 at 0.126 level of significance.

There were also small differences between the results for females and those for males. For females, it was 0.66 at 0.1094 level of significance while for males, it was 0.58 at 0.2012 level of significance. For both, however, the correlation is statistically significant being stronger in females than in males. However, the conclusion can be drawn that females tend to be more affected by the place of residence than the males.

According to Thomas (1985) one of the most important factors that underlie socio-economic differences in the Transkei is whether one happens to be an urban or a rural resident. Several reasons account for this. There is, for instance, the fact that urban residents earn more than rural residents and have more modern facilities than rural residents.

#### **4.13.7 Parental/Guardian Level of Educational Attainment and Level of Understanding of Models**

A considerable number of the students (27,4%), mostly from the rural areas, had parents who have had no education whatsoever. Of the rest of the parents many had obtained some form of education although this was mostly primary school education. There were however quite a number with post matric education especially nurses (9% of the students), and teachers (8% of the students). Parents with university education were however few (0,4%, all from the urban area), but many parents were studying in post-matric institutions. The educational score of each parental group, as presented in Table 4.9 , was computed as by adding up the relevant figures, as given below:

No education	=	0
Completed Primary School	=	1
Completed Junior secondary school	=	2
Completed senior secondary school	=	3
Completed a post matric institution other than university	=	4
Having a university degree	=	5
Having post graduate degrees	=	6

Many of the students (36%) had only single parents and to avoid distortions the educational score of the parents was divided by the number of parents (Chapter Three). Where a parent started a certain level of education but did not complete or still studying he/she is awarded half of the educational score of that level.

The correlation between parental education and the level of understanding of models of the pupils is 0.74004 at 0.0001 level of significance (N = 341). There is therefore a strong positive correlation between parental education and the level of understanding of the models. The correlation is also very highly significant. The strong positive relationship implies that children of parents with a high level of education had a higher level of understanding of models than those whose parents had had little or no education at all. Indeed of those obtaining 50% and over in the tests, 63,2% had parents who had obtained education up to the standard ten level. Thus there is enough proof that parental education is very strongly related to the educational attainment of the children.

**TABLE 4.9 : PARENTAL EDUCATION AND THE MEAN ACHIEVEMENT SCORE OF STUDENTS**

<b>EDUCATIONAL LEVEL OF PARENTS</b>	<b>ACHIEVEMENT SCORE</b>	<b>NUMBER OF STUDENTS</b>
2	23	6
3	27	8
3.5	27	7
4	32	27
4.5	32	32
5	39	62
5.5	46	11
6	39	36
6.5	47	28
7	49	17
7.5	51	15
8	47	22
8.5	48	21
9	48	13
9.5	48	1
10	49	18
10.5	47	2
11	48	2
11.5	49	1
12	50	2
<b>TOTAL</b>		<b>341</b>

Source: Field Survey, 1992.

#### 4.14 Correlation Matrix

All the correlation co-efficients can be put in a matrix to reflect an order of ranking. This is presented in Table 4.10 below.

**TABLE 4.10 : MATRIX OF CORRELATION CO-EFFIENCIES**

Level of Education of Parents	.74
Listening to the Radio News	.72
Length of Time Studying Geography	.71
Age	-.67
Place of Residence	.62
T.V. Viewing	.60
Sex	.58

The ranking reveals that the level of education of parents had the strongest relationship with the level of understanding of models. It is therefore the factor that affects school pupils in the Transkei the most as far as the level of understanding of models is concerned. Similarly sex had the weakest relationship with the level of understanding of models.

#### 4.15 Student Perception

While statistical techniques may reveal a pattern their use can be misleading especially when such results are applied to real life situations (Bailey, 1973). A better method is to combine statistical techniques with other methods to obtain a more comprehensive picture. In this research therefore it was found necessary to investigate whether student assessments were in consonance with the conclusions that were arrived at from the statistical analysis. In this connection pupils were asked on a scale of 1 to 4 (ranging from well understood to poorly

understood) to rate their level of understanding of the models they have been exposed to.

The results are presented here below in Table 4.11 :

**TABLE 4.11 LEVEL OF UNDERSTANDING OF MODELS**

MODEL	LEVELS OF UNDERSTANDING			
	1	2	3	4
Gravitational Pull	254	87		
Model of Demographic Transition		187		
The Structure of the Atmosphere	49	112	180	
Agricultural Systems		150	191	
Models of Urban Structure			115	226
Factors Influencing Death Rates		34	108	199
A Farming System	204	137		
Volcanic Intrusives	151	190		

Source: Field survey, 1992

The results presented above indicate that the first, third fifth , sixth and eight were judged to be those that were very well understood. With the exception of model five these results are consistent with the performance in the test in the sense that where pupils did better in those models they claimed to understand and performed poorly in those models they claimed not to understand. Further probing of these results is necessary to identify the problems with the understanding of models among school pupils in the Transkei. This aspect of the research is to be taken up in the next chapter.

Thereafter teacher practices will also be examined in a follow-up chapter to identify the other factors behind the problems identified.

## **SUMMARY**

This chapter has presented the results to test the level of understanding of models. The analysis has indicated that pupils do well in the pictorial models than in the other models. The analysis carried out in this chapter has also revealed seven major factors responsible for differences in the level of understanding of models among pupils in the Transkei. These are: the frequency of watching television, the frequency of listening to the radio news, sex, age, the length of time spent studying Geography, one's place of residence, the type of model and the level of education of ones parents or guardians. From the strength of the various correlation co-efficients considered and with only one exception (sex) the pattern that emerges is that of two broad groupings of the variables according to their relationships: one group representing positive relationships. These are: frequency of watching television, the frequency of listening to the radio news, place of residence, length of time studying Geography and parental or guardian's level of education. The other group with only one factor (age) where the relationships are negative. To identify the particular group of factors responsible for differences in the level of understanding of models there is a need to probe further, to group the factors and unmask their underlying factors. This will be carried out in the chapters that follow.

## *CHAPTER FIVE*

# **KEY FACTORS INFLUENCING THE CONCEPTUAL UNDERSTANDING OF MODELS**

### **5.1 Introduction**

In the previous chapter certain problems were identified, through the techniques of correlation analysis as being factors affecting the level of understanding of models used in Geography textbooks in the Transkei. As indicated in the summary it was noted that a number of general factors affected the pupils' level of understanding of the models. This by itself, however, does not enable one to identify the broad pattern of the problems with the understanding of models in Transkei so that meaningful recommendations could be made. That is because it was impossible to consider each of the many co-efficients in the correlation matrix separately at any length. The reason is that a certain amount of information overload was associated with the technique. A method of obtaining subsystems or groups of variables from the matrix of correlation co-efficients is therefore important to facilitate a greater degree of description and explanation and to expose more information. This chapter intends to explore this possibility and through that to identify the key factors influencing academic achievement including an understanding of the models used in Geography textbooks in the Transkei.

### **5.2 Deriving the Factors**

The order, pattern or regularity in the complex interrelationships among measures can be investigated mathematically via the multivariate technique of common factor analysis.

Common factor analysis is a member of a family of techniques called factorial analysis. Their general purpose is to unravel the patterns of variations exhibited by a set of variables (Rummel, 1970). A complete factor analysis of a data matrix is mathematically unique. It must be stated though that factor analysis solutions depend on the initial mix of the input variables and the intercorrelations they exhibit.

In using factor analysis it is always better to do two series of factor analyses so that a clearer picture can be obtained. For this research it is proposed to use the covariance matrix and the correlation matrix. For these two series two methods were employed: (1) principal components and (2) the maximum likelihood. With these two methods it was hoped that in the end whatever results obtained would give the best indication of the overall pattern of the data. The factor loadings for the two methods appear as Table 5.1 (principal component) and Table 5.2 (least likelihood).

**TABLE 5.1 : FULL VARIMAX ROTATED FACTOR LOADINGS**

<b>FACTORS</b>	<b>FACTOR ONE</b>	<b>FACTOR TWO</b>
Place of Residence	0.05380	0.02827
Watching Television	0.73584	0.15362
Parents' Educational Level	0.71375	0.38059
Listening to Radio Programmes	0.61940	0.79511
Length of Time Studying Geography	0.82890	0.07995
Gender	0.06580	0.64140
Age	0.05380	- 0.02827

Source: Computer Centre, University of Transkei

**TABLE 5.2 : LEAST LIKELIHOOD FACTOR PATTERN**

<b>FACTORS</b>	<b>FACTOR ONE</b>	<b>FACTOR TWO</b>
Place of Residence	0.08851	0.36839
Watching Television	0.74534	0.28376
Parents' Level of Education	0.77267	0.31057
Length of time Studying Geography	0.55064	0.67580
Listening to Radio Programmes	0.62217	0.57080
Gender	0.17194	0.71648
Age	0.06620	- 0.07972

Source: University of Transkei Computer Centre

To discover the pattern revealed by the two factor loadings presented above the correlation co-efficients were transformed into eigenvalues and their associated eigenvectors. By means of this the different dimensions of the variable structure were obtained and the percentage variances associated with each derived. Varimax rotation was also employed to facilitate the labelling of the factors. The number of factors derived were therefore the independent factors accounting for the variations in the scores. Table 5.3 indicates the eigenvalues and the percentage variance accounted for by the factors from the first method.

**TABLE 5.3 : CONTRIBUTION OF THE MAIN FACTORS**

<b>FACTOR</b>	<b>EIGENVALUE VALUE</b>	<b>% VARIATION CONTRIBUTED</b>	<b>CUMULATIVE PERCENTAGE</b>
Factor One	3.642	50.03	50.03
Factor Two	2.884	36.91	86.94

Source: Computer Centre, University of Transkei

Table 5.3 reveals that factor one accounts for 50.03% of the total variation. Another 36.91% is accounted for by the second factor. The combined percentage variance accounted for by the two factors is 86.94%. Thus it can be concluded from the table that variations in the level of understanding of models among the respondents can be attributed in large part to these two factors since they contribute as much as 86.94% of the variation.

From the second method the following was obtained as indicated in Table 5.4 below.

**TABLE 5.4 : CONTRIBUTION OF THE MAIN FACTORS**

<b>FACTOR</b>	<b>EIGENVALUE VALUE</b>	<b>% VARIATION CONTRIBUTED</b>	<b>CUMULATIVE PERCENTAGE</b>
Factor One	3.776	53.94	53.94
Factor Two	2.924	37.48	91.42

Source: Computer Centre, University of Transkei

From this table the picture obtained is similar to the first as 53.94% is explained by factor one and 37.48% by factor two. Together the two factors explain 91.42% of the variation.

These two analyses thus indicate that there are now only two factors of importance to contend with as far as variations in the level of understanding of models is concerned instead of the seven factor loadings. This factor analytic technique has thus helped to narrow the number of factors and to achieve an economy of description. Variations in level of understanding of models can thus be explained in terms of the two factors.

The identification of the factors constitutes a very important step in the analysis. Although other research has been undertaken on the determinants of academic achievement in the Transkei, none have utilised this technique to systematically derive the major dimensions or factors determining variations in level of understanding of models (as an aspect of academic achievement) among school pupils in the Transkei. This section of the research has therefore helped to identify the major group of factors responsible for causing variations in the level of understanding of models in the Transkei.

### **5.3 Naming the Factors**

The labelling or identification of the factors constitutes a most important step in the analysis. In using factor analysis to construct an index the first factor is very important. This is because it is the best transformation or reflection of the general pattern. From the index therefore factor one is of key importance in the analysis.

An examination of the factor loadings of factor one reveals that level of understanding of models is positively related to all of the variables. The group of factors contributing high percentage variations to factor one are all factors inherent in the environment (both home and school) of the pupils. These are parental/guardian level of education, frequency of television viewing, frequency of listening to the news on radio, length of time spent studying Geography and place of residence of the school child. Their effect contributes over 50% of the variation in the level of understanding of models. The conclusion is therefore that environmental conditions have a stronger influence on the level of understanding of models in the Transkei than other factors. Factor one can therefore be labelled environmental factor.

Factor two contributed about 37% to the total variations. In this case there was one positive and one negative factor loading. Their influence is comparatively weak. The higher positive factor loading was from sex while the negative factor loading was from age. These are factors located in nature and thus this factor is labelled as such. From this analysis it is concluded that the level of understanding of models in the Transkei is affected far more by home environmental conditions than by nature.

The summary above has employed the technique of factor analysis to group the factors into two broad categories: Factor one and Factor two. The grouping was done to simplify the data so that one could identify the particular group of factors responsible for causing variations in level of understanding of models among school pupils in the Transkei. Through the grouping, the contribution of each of the factors to variations in the level of understanding of the models used in Geography textbooks in the Transkei was assessed. From the assessment, it was discovered that home environmental conditions had more influence on the level of understanding of models in the Transkei than any other factor.

It has always been known that factors or processes in any region neither operate singly nor randomly. Particular patterns (as in variations in level of understanding of models) are generated by specific processes that operate in a region (Taylor, 1977). In the next section therefore the identified factors are related to the observed characteristics within the study region. From the examination it is hoped that the processes through which environmental conditions work to influence the level of understanding of models in the Transkei may be outlined.

#### **5.4 Factor One - Environmental Conditions**

The group of factors that contributed high scores to factor one (ie environmental conditions) are parental/guardian level of education, frequency of television viewing, frequency of listening to radio programmes, length of time spent studying Geography and the child's place of residence.

With the exception of parental education and length of time spent studying Geography, these groups of factors are dependent on the level of living in a country which is also affected by the birth rate among others. In the Transkei, like in many other developing countries, the birth rate is a high 2.7% per annum or 27 per 1000. Consequently the large family is the typical one. The causes of the high birth rate may be traced to certain socio-economic factors prevalent within the community. As Nkuhlu (1985:485) has stated, "the question of human values and attitudes, which is determined by culture and religion, cannot be ignored in studying the problems of development". The absence of a parent is also related to the high level of unemployment in the Transkei.

Frequency of listening to the radio news or to watching television is dependent on its availability. In the case of the Transkei these are predominantly confined to the urban centres. Unfortunately and as noted in Chapter One the vast majority of Transkeians live and work in the rural areas. The problem of rural\urban differentials in the Transkei can be viewed from two angles. In the first place it can be examined from the point of view of the availability of certain indices. Modern developmental indices such as electricity, roads, hospitals, post offices etc affect the spread of innovations and people's accessibility to information as it relates to the use and availability of contraceptives. In

the Transkei all these indicators of development are state controlled and are provided mostly to town dwellers. Where provided in the rural areas specifications to which they are built differs from that of the town, the town one being of better quality than those in the rural areas. While rural housing is an individual's affair urban housing is state controlled and built to very high standards. The result is that spatial imbalances in development are made more evident especially between urban and rural areas. Secondly and perhaps more importantly rural dwellers earn less income and are more illiterate than urban dwellers. The poor economic position of many rural dwellers increases the pressure on school pupils to go out and look for work early in life. As pointed out earlier in Chapter Three only 36% of those in standard eight continue their education further with another 38% of that leaving school at the end of standard nine. Many rural residents, therefore, stay ignorant of the complex relationship between socio-economic conditions and educational achievement or are unable to afford basic school material for their children. They therefore find themselves unable to provide the motivation that will improve the academic achievement of their children. The relative economic privilege of the group of children resident in the urban areas stems from the fact that they come from homes that value education and therefore have environments conducive to it. What is worse in the Transkei is that there is no Economic Planning Bureau or Department which can continually update socio-economic statistics and other information (Nkuhlu, 1985). Thus the status quo continues to be maintained.

It must be stated though that these factors are all outside the school situation. Thus in the search for the forces and factors behind an existing educational problem the focus is on issues outside the school. To Sadler, this is because "..... the things outside the school matter, even more than things inside the schools and govern and interpret inside" (Tretheway, 1976:18). Many other studies have also stressed the strong relationships "..... between education and society and between teaching and learning outcomes" (Noah and Eckstein, 1969:114). The formal school education naturally has its effects on the child as he grows into adulthood but it is dependent on the kind of school situation and the environmental stimulus he has received from his home background (Morrish, 1977).

### **5.5 Factor Two - Nature**

The two factors contributing a high score to factor two - nature are age and sex. Their influence on variations in the level of understanding of models has been shown to be weak. The small association between this factor and the level of understanding of models, besides the environmental factors, can be explained in terms of general causal factors in biological make up, and psychological functioning. The effects of these factors occur over time and are reinforced within a specific socio-economic environment. For instance it is known that a strong negative relationship exists between sex role conditioning, self-esteem, mental health and academic achievement (Bandura, 1969; Mischel, 1966; Long, 1986). It is held that traditional roles for especially females have a negative effect on competency in many tasks (Walker, 1978). Women who are victims of domestic violence, in particular have been shown to reflect lower self-esteem and greater helplessness, passivity, dependency, and acceptance of traditional male-female sex

roles than non victims (Walker, 1978). The effects of traditional roles on especially women have been traced to such other problems as the discrediting of their abilities and the attribution of success to factors other than their own competency (Clance & Imes, 1978; Deaux, 1976). The negative influence of traditional sex roles in Southern Africa on competency, affect both males and females (Vetta, 1986). Thus, masculinity and femininity are no longer to be regarded as mutually exclusive as the endorsing of both traditional masculine and feminine roles has been shown to have a negative effect on mental competency (Singer, 1976). In a community where sex roles are still taught to the young, their negative effect on mental health and competency (as in academic achievement) will definitely be great (Helmreich & Stapp, 1975).

#### **5.5.1 Biological Make-up**

Biologically, males have always been shown to be more susceptible to prenatal complications such as anoxia (Stevenson, 1966; Stevenson, and Bobrow, 1967). The majority of miscarriages are infact male foetuses (Stevenson and McClarin, 1957). In terms of live births the ratio between males and females is 106:100 (Stevenson and Bobrow, 1967). Throughout life males remain more vulnerable to a variety of disorders e.g. cerebral palsy, viral infections, ulcers, coronary thrombosis and some of mental illness (Taylor and Ounsted, 1972; Garai, 1970). In the Transkei, male births surpass female births, but by the age of ten females have already surpassed males (Census figures, 1985, Transkei). Extreme poverty (rural incomes stands at less than R200 p.a), leading to poor nutrition, poor accommodation and lack of basic facilities combine to

reduce life spans. Because males are biologically weaker the combination of poor environmental conditions and a weaker make-up tend to have greater effects on them.

Growth velocity in males lags nearly two years behind the female's (Tanner, 1970). For instance, bone ossification is completed much later (Hutt, 1972b); and puberty is attained about 2,5 years after those of girls (Nicholson and Hanley, 1953). In terms of maturity the newborn girl is equivalent to a 4 to 6 week old boy (Garai and Scheinfeld, 1968). It seems reasonable to conclude that the earlier maturity of girls give them a higher ability in both academic and other tasks. It is no wonder therefore that there is "... a greater responsiveness of girls to achievement demands and educational stimulation in middle childhood" (Werner, 1969). As noted earlier on in Chapter Four the girls did better in the tests of the level of understanding of the models than the boys. Girls in fact lateralise many cerebral functions earlier and more effectively than males (Taylor, 1969; Buffery, 1971) and hence acquire greater proficiency in them initially. This earlier maturation is reflected in the better academic achievement of girls.

Evidence from longitudinal studies however suggests that in later life several of the female advantages are lost and males increasingly dominate many intellectual tasks (Werner, 1969). Shouksmith, (1970), for instance, confirms that adult males are more creative than adult females. For example, Maccoby (1966) cites a study of Radcliffe College academics which found males to be considerably more productive than females. Thus variations in abilities between males and females is dependent on time. This also suggest that in looking for the factors accounting for variations in the academic

achievement of older students the time element in biological differences should be stressed.

### **5.5.2 Psychological Functioning**

To Burt differences in academic achievement between males and females is psychological and is related to the degree of predominance of certain mental processes. To him, "in the adult man the cortex tends to appear more completely organised but in the adult woman the thalamus .... the mental life of man is predominantly cortical, that of woman is predominantly thalamic" (Burt, 1924, p.688). To him the predominance of the thalamic mental life of man is instrumental in his superior ability in many tasks including academic achievement.

While accepting that not much can be done about the effects of nature on academic achievement it is gratifying to note that their contribution to variations in academic achievement is weak. Much influence can however be exerted on the socio-cultural environment. The recognition of demographic differences and their effects on level of understanding of models should therefore enable one to modify and/or exploit environmental circumstances to profitable advantage.

## **SUMMARY AND EDUCATIONAL IMPLICATIONS**

This chapter has grouped the many factors identified in chapter four as causing variations in the level of understanding of models into two major categories. These are the environmental factors and factors attributable to nature. The chapter has also outlined why the variations therein are more strongly affected by environmental factors. The

underlying factors to the observed pattern has also been outlined in this chapter. One important implication of this research for educational practice is the realisation that differences in academic achievement among students reflect deficits in home background. Since this can be corrected the research offers the likelihood that intervention through additional help and instruction offered to certain students and families can correct some of the problems created by variations in the level of understanding of models and academic performance in general among school pupils in the Transkei.

## **CHAPTER SIX**

# **TEACHERS' ATTITUDES TOWARDS MODELS**

### **6.1 Introduction**

This chapter reviews the major conclusions of the research conducted into the attitudes of teachers towards models used in Geography textbooks and teaching practices with respect to models. The chapter also correlates the conclusion of the previous chapter with the observations in this chapter. It must be noted however that the manner of teaching is often determined by the education system which is a product of the political system. In the Transkei problems facing black rural folk such as housing, water supplies etc do not feature in the school syllabus. The view presented is therefore narrow. The discipline is also strictly compartmentalized into areas like geomorphology, climatology, economic geography and regions of the earth's surface with little links between them. The main objective of Geography education has been and still is to provide pupils with factual knowledge.

### **6.2 Attitudes Towards Models**

Models used in Geography textbooks have changed considerably with time both in its emphasis and methodology and in its role in education. This changing role has impacted differently on both teachers' and pupils' perceptions and attitudes. While models cannot be studied in isolation because it is a part of a discipline which is a part of the whole education system which is also a part of the social and economic environment within which it evolves, the emphasis in this chapter will be on the attitudes and perception of

the teachers towards models used in geography textbooks. The way models are used in geography textbooks is also a reflection of teacher know-how and of developments in the discipline.

Hundreds of publications attest to the strong interest of educators in the role of study habits and attitudes in determining academic success. Studies suggest that the degree of steady highly motivated effort put forth by the student and his attitudes toward school work, rather than the purely mechanical procedure of studying might be of considerable importance. As a result several investigations have been done on attitudes to particular school subjects. As early as 1941 Jordan examined the attitudes of pupils to English attainment among 11 to 15 year old boys. Majoribanks (1976) examined the attitudes to English and ability which to him differed at different levels of ability. Biggs also found attitudes to Mathematics (1959) to be strongly related to attainments in the discipline. He suggests that "where the subject is intrinsically easy, pupils attitudes are less closely correlated with success than where the subject is generally perceived as being difficult". Keys and Omerod (1976) found that attainment correlates with subject preference and subject easiness.

The role of attitudes in learning can be located in two major areas:

- (1) Theories of Learning which holds that people tend to adopt certain attitudes towards some objects due to the particular reinforcements arising therefrom; and
- (2) Personality Theories which hold that there is dynamism in individuals, therefore, a person's attitude should develop and change under the influence of the roles that they play in personality adjustments and transactions.

In this connection the word attitude which comes from the latin word aptus meaning fitness or adaptedness is defined as determining for each individual "... what he will see and hear, what he will think and what he will do" (Allport, 1954, p. 43-45). Attitudes enable the individual to "slip into some frame of mind peculiar to himself" (Allport, p. 22). The word has also been used to refer to the state of mind of the individual towards a value. Love of money, racial discrimination, desire for fame, hatred of foreigners, respect for scientific doctrines are all typical attitudes. According to Allport (1935) four conditions emerge for the formation of attitudes (1): the integration of numerous specific responses within an organised structure, (2) the differentiation of more specific action patterns and conceptual systems from primordial, nonspecific attitudes of approach and withdrawal; (3) trauma involving a compulsive organisation of mental field following a single intense emotional expression and (4) the adoption of attitudes by imitation of parents, teachers or peers (Allport, 1935, p. 810-812). Indeed, attitudes are a part of the general acquired behavioural dispositions (Campbell, 1963:107-111).

The importance of an attitude in this research is the fact that it determines what the individual will do, or not do, and even how he will do what he does. Several studies attest to the view that the nature of one's perception of his environment can provide meaningful cues for the analysis of his behaviour and personality (Combe and Syngg, 1959). One reason for instance is that one's perception of his environment constitutes not only his reality but also the frame of reference for his actions and personality (Lewin, 1948; Bruner, 1951; Boy and Pine, 1968). To them the positive and negative self-concept so formed from the way the individual perceives his environment gives rise to positive and negative behavioural patterns respectively. From the foregoing it can be assumed

that the school environment is capable of influencing the behaviour of those who live and work in it - teachers and students.

### 6.3 Characteristics of Respondents

In trying to assess the attitudes of teachers 30 teachers (Chapter Three) were selected. Of this 10 were males and 20 were females. Table 6.1 below summarises the academic qualifications of the respondents.

**TABLE 6.1 : ACADEMIC QUALIFICATIONS OF RESPONDENTS**

<b>Matric Certificate</b>	<b>B.A.</b>	<b>B.Sc.</b>	<b>B.PEd</b>	<b>B.Ed.</b>
12	8	2	6	2

Source : Field Survey, 1992

From the table above, it can be deduced that sixteen of the teachers had degree certificates with two of them having post-graduate qualifications (B.Ed). Only nine of the teachers did not have professional qualifications. The vast majority of the respondents, 90%, (27 out of 30) had received their training after 1970. Level of experience was however low with 20 of the teachers having taught Geography only during the last three years. All the teachers use the *New Window of the World* and/or the *Senior Geography Series*.

### 6.4 Order of Difficulty

The first of the series of questions designed to assess the attitudes of teachers towards models enlisted their views on the difficulty of models. In this connection the models used for the test of pupils' understanding (Chapter Four, pp 58-60) were listed and

teachers were asked to rank them according to their order of difficulty. Table 6.2 below summarises the responses.

**TABLE 6.2 : ORDER OF DIFFICULTY OF MODELS**

MODEL	ORDER OF DIFFICULTY							
	E A S Y ..... < ..... < ..... > ..... > ..... D I F F I C U L T							
	1	2	3	4	5	6	7	8
GRAVITA-TIONAL PULL	1	1	5	2	6	4	4	7
URBAN STRUCTURE					3	3	6	18
VOLCANIC STRUCTURE			9	7	11	3		
FARMING SYSTEMS	16	12		2				
STRUCTURE OF THE ATMOSPHERE							9	21
AGRICULTURAL SYSTEMS	4	20	2	4				
DEMOGRAPHIC TRANSITION			6	8	16			
FACTORS INFLUENCING DEATH RATE				19	7	4		

Source: Field Survey, 1992

The responses summarised above do indicate that the model of farming systems and the model of the agricultural systems are perceived to be easier than the models of urban

structure and that of the structure of the atmosphere. From this it can be deduced that some models are perceived as being easy than others. The type of model used does therefore affect teachers' perception and by extension their level of understanding and use of them. It also implies that there is a need for more of certain types of models in geography textbooks than other types of models. There were a few significant differences in the responses among the various categories of the respondents.

With respect to the difficulty of certain models used in Geography textbooks a chi-square test revealed significant differences in responses between urban and rural respondents and between graduate teachers (degree holders) and non-graduate teachers with respect to the models of gravitational pull, of urban structure and of demographic transition. The Chi-square Test revealed P. values of .0027, .0019, and 0043. An analysis of these results indicate that a majority (65%) of those teachers who worked in rural areas felt models one and three was generally more difficult than those teachers who worked in the urban areas. On the other hand rural teachers felt the model of agricultural systems were generally less difficult than did teachers who worked in urban areas. Similarly, graduate teachers felt these models were generally less difficult than non-graduate teachers.

The sharp differences in development between rural and urban areas in the Transkei (Thomas, 1975) are such that rural residents are unfamiliar with a lot of issues. These would include models of urban structure and gravitational models. On the other hand they would be familiar with agricultural systems. The issue of familiarity is therefore identified as a major problem with the use and understanding of models. Another

revelation from these results is the differences in the perceptions of graduate and non-graduate teachers. It is interesting to note that their perceptions are generally different from those of the pupils (chapter four) with respect to the pictorial models. However, these two groups (pupils and non-graduate teachers) are in agreement with respect to the model of urban structure. One explanation for the teachers perceptions could be the lack of familiarity on the part of pupils as noted earlier on and the difficulty non-graduate teachers have with teaching such unfamiliar models. In either case, further probing is necessary to identify the reasoning behind these perceptions.

## **6.5 Degree of Difficulty**

Teachers were thus asked to rank the models in terms of their difficulty. Having ranked the models teachers were further asked to assess the degree of difficulty of the models ranked in terms of it being "too easy", "too difficult" or "just right". This was to allow further enquiry to assess the problems relating to the use of models for geography education. Table 6.3 summarises the responses.

The results presented above indicate that the majority of teachers viewed models such as those of the demographic transition, urban structure, atmosphere and volcanic intrusives as being too easy. Unfortunately this does not come out from the performance of the students (Chapter Four). The conclusion is therefore that the perceptions of teachers is contrary to the perceptions of pupils. This could be one of the major problems with the use of models for Geography education. Using chi-square tests significant differences in the perceptions were established as a result of differences in teacher qualifications.

**TABLE 6.3 : DEGREE OF DIFFICULTY OF THE MODELS**

MODEL	DEGREE OF DIFFICULTY		
	TOO EASY	JUST Right	TOO DIFFICULT
1. Gravitational Pull	6	16	8
2. Demographic Transition	8	12	10
3. Urban Structure	2	12	16
4. Structure of the Atmosphere	4	18	6
5. Factors Influencing Death Rate	6	14	10
6. Volcanic Intrusives	12	16	2
7. Agricultural Systems	14	12	4
8. Farming Systems	6	14	10

Source: Field Survey, 1992

With respect to the responses gathered on the perceived degree of difficulty of models, there were only three models (models of the demographic transition, structure of the atmosphere and of the factors influencing death rates) where statistically significant differences were recorded. The P. values for these models were .000458, .000160 and .00472. With respect to model 2 (model of demographic transition theory) 57.4% and 56.9% of those who either agreed that it was too easy, or just right respectively were teachers teaching in the urban areas. The majority of rural residents felt it was too difficult. Judging from the performance of the pupils it seems this latter perception should be accepted. However, contrasting these results against the fact that about half (49.7%) of the rural respondents are teachers with lower qualifications than their urban counterparts the conclusion can be drawn that it is the poorer qualified teachers who felt

that this particular model is difficult. Teacher qualifications is therefore identified as one problems militating against the conceptual understanding of models by pupils.

Model 4 was a graphical structure of the atmosphere and respondents were asked to assess its degree of difficulty. In this particular case two statistically significant differences were established in the results. The P. value was .0097. An examination of the results revealed that 82.8% of those who felt that this model was too difficult were teachers with matric certificates. Most of them also teach in the rural areas. However, this viewpoint also comes out strongly in the pupil's performance (Chapter Four).

Generally pupils tended to do better in the pictorial graphs than in the line graphs. The better qualified teachers however, feel that this particular model is easy which contradicts with the performance of the pupils. This and the previous analysis leads one to draw the conclusion that the better qualified a teacher is, the more his views on model difficulty contradicts those of his pupils. Teacher qualifications therefore emerge as one of the most important considerations in the use and understanding of models.

The last significant difference (P. .0050) was with the assessment of the model on the factors affecting the crude death rates. The significant difference in the responses was attributed to level of experience. The majority of teachers who have been teaching for longer than three years (6 out of 10) felt this particular model was difficult for pupils to understand. On the other hand the majority of teachers (72%) with teaching experiences less than three years felt that this model was easy for pupils to understand. It can be deduced, therefore, that teaching experience happens to be one important factor with

model understanding. Comparing these results with the pupils' perceptions it is noted that the assessment of the teachers with teaching experience of three years or more is in agreement with the perceptions of the pupils. It is also in agreement with their performance. Once more there appears a disjunction in perceptions between teachers and pupils with respect to teachers who have taught for less than three years.

To further understand the disjunctions in perceptions between pupils and teachers, teachers were asked to indicate how often they used models in their own classrooms. The rationale being that teachers will be more inclined to use those models they viewed as being easy more often in their classrooms than the others.

## 6.6 Frequency of Model Usage

The table below summarises the frequency of model usage among the respondents.

**TABLE 6.4 : FREQUENCY OF MODEL USAGE**

<b>FREQUENCY</b>	<b>NUMBER OF TEACHERS</b>
Never	2
Sometimes	13
Seldom	4
Often	7
Very Often	4

Source: Field Survey, 1992

The summary presented above indicate that model usage is not frequent among teachers.

Fifty per cent of the teachers either never or only sometimes use models while only 11

(37%) either often or very often use models. The conclusion that emerges from these results is that pupils are generally unfamiliar with models because teachers do not use them often. This tends to affect their level of understanding of them. However the results also display distinct differences in usage. Teachers with university degrees were more liable to use models than teachers without degrees. This can be deduced from the fact that all the eleven teachers who often or very often use models are teachers with university degrees. Needless to say (because these are all university graduates) the vast majority (90%) of those who use models often or very often teach in urban areas. Urban children therefore stand at a huge advantage with respect to model familiarity and by extension greater understanding than rural pupils. The distribution of the better qualified teachers therefore has a lot to do with exposure and level of understanding of models.

This study also attempted to examine the reasoning behind the apparent reluctance on the part of teachers to use models often even though they are found on almost every page of the textbooks they use. Item 16 of the questionnaire to teachers (Appendix B) sought to answer this question. All the teachers indicated that they have to explain and simplify the models whenever they use them. This they regarded as an unnecessary extra effort. This reflects on the presentation of the models. It indicates that appropriate clues should be included with the model presentations. It might be understandable for teachers to be reluctant to increase their work loads considering the general overcrowded nature of the schools (resulting from large teacher-pupil ratios) in the Transkei and consequent heavy workloads. However the finding raises problems with the quality of Geography education in the Transkei and also poses further difficulties for pupils in the territory

with respect to model usage. A last attempt was made to assess the perceptions of teachers on models with respect to whether there were enough models or not and the utility of the models in general to Geography teaching.

## **6.7 Perceptions About Models**

Items 25 to 29 of the questionnaire to teachers (Appendix B) assessed the perceptions of teachers with respect to the number and utility of models in the Geography textbooks.

Table 6.5 below summarises their perceptions. From the table it can be deduced that while 18 out of 30 teachers disagree or strongly disagree that the number of models in Geography textbooks should be reduced, 16 out of the 30 teachers agree or strongly agree that models use up a lot of teaching time. This latter perception is in consonance with the conclusions on model usage. This conclusion is in spite of the fact that 22 out of the 30 teachers strongly agree or agree to the statement that the more they use models the more their pupils understand them. In spite of this observation it is known that many teachers (Note 6.5) do not use models often. This, there is no doubt, is one of the major problems faced by pupils in understanding models. Respondents were equally divided on whether pupils found models difficult or not.

From table 6.5 several deductions can be made. In the first place it can be deduced that most of the respondents find the number of models in the Geography textbooks adequate. Most of them also prefer textbooks with lots of models. They are however almost equally split on whether models use up too much teaching time. Similarly

respondents are almost equally split on the fact that their pupils find models difficult to understand.

**TABLE 6.5 : PERCEPTIONS ABOUT MODELS**

ATTITUDINAL STATEMENT	SA	AG	UND	DA	SDA	TTL
Number of Models in Geography Textbooks should be reduced	8	7	1	12	2	30
I prefer a textbook with lots of models	8	13	0	5	4	30
Models use up too much teaching time	6	10	0	10	4	30
Pupils find models difficult to understand	3	12	1	11	3	30
The more I use models, the more I understand them	10	12	1	4	3	30

Source: Field Survey, 1992

Several significant differences emerged in these perceptions. These differences were with respect to sex, qualifications, and residence of teachers. Items 2 and 3 concerning whether teachers liked textbooks with a lot of models in them and whether teachers felt models took up a lot of teaching time recorded the most significant differences. In both the P. values was .0001. An examination of the results reveals that the majority (68%) of teachers from rural schools felt there were enough models in Geography textbooks. Most (59%) also felt models took up a lot of teaching time. If there were pressures with respect to workloads it is generally known that rural teachers, because of large pupil populations, experience them the most. It is not surprising that they would prefer ways of reducing it. However the performance of the rural pupils in the test of level of understanding reveals that rural pupils need more exposure to models if they are to increase their understanding of them.

Item 4 sought teachers' responses as to whether models were difficult for pupils to understand or not. In this item a P. value of .0027 was recorded in the responses between male and female teachers. An examination of the results reveals that 82.8% of the 40.3% who agreed or strongly agreed with this suggestion were males. 56.5% of those who strongly disagreed or disagreed with this suggestion were females. Males also displayed a greater degree of indecision (63% of the undecided) than females. It is of note that in this case the perceptions of the male teachers was more in consonance with those of the pupils.

### **6.8 STYLE OF MODEL USAGE**

Section C of the questionnaire assessed the usage of models in the classroom. In this section there were eighteen items but the responses were significant in only a few of them. Item 13 for instance, sought to know whether models should be used with pupils in the Senior primary school or not. 80% of the respondents felt that models should be used with this group of students. However concerning item 14 it was noted that only 10% of the respondents use hardware models. This is a major weakness in teaching strategy since hardware models are expected to provide more explanatory value. There was a significant difference in the number of times pupils are taken out on field trips between rural and urban residents (Item 16 of the questionnaire). The majority of urban resident pupils (68%) are taken out once a quarter while the majority rural resident school pupils (79%) are only taken out once a year. Correlating these results with performance it can be concluded that the level of understanding of models tended to increase the more often a pupil was taken on field trips. Frequency of attendance of

field trips is therefore identified as one of the most important factors affecting the level of understanding of models.

One major fact that is likely to affect the level of understanding of models is the teaching strategies employed by teachers. In this connection item 18 sought from teachers the teaching methods they employed in terms of frequency. Table 6.6 below summarises the responses from the teachers to this item. It must be noted that the level of frequency ranges from 1 (infrequent) to 5 (very frequent).

**TABLE 6.6 : TEACHING STYLES**

**LEVELS OF FREQUENCY**

<b>METHODS</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>TOTAL</b>
Teacher Tell	1	1	0	10	18	30
Group Discussions	0	2	3	7	8	20
Question and Answer	4	6	1	8	11	30
Fieldwork	4	0	3	2	7	14
Practical Work	3	0	12	11	4	30
Games and Simulations	0	3	2	0	3	8
Models	10	12	1	4	3	30

Source: Field Survey, 1992

The results presented above indicate that Geography teachers mostly employ the techniques of teacher tell, question and answer, practical work and models for teaching. Few teachers use games and simulations, and fieldwork. Indeed the majority of teachers only use teacher tell method. This method in which the the teaching/learning

revolve around the teacher does not promote understanding of models. This factor is therefore one of the major problems that is likely to affect the level of understanding of models used in Geography textbooks. In order to throw further light on this, the teaching strategies of the 12 respondents (chapter three) were compared to the results of the test from their schools. The results appear as Table 6.7.

**TABLE 6.7 : TEACHING STYLE AND MEAN SCORE OF PUPILS**

SCHOOL	MOST FREQUENT	NUMBER OF	MEAN
MTEBELE	TEACHER TELL	88	32%
VULLI VALLEY	TEACHER TELL	81	47%
ZWELANDILE	TEACHER TELL	75	42%

Source: Field Survey, 1992

Because all the teachers mostly used teacher tell style these results by themselves do not provide adequate explanatory value. However upon further examination it was discovered that in the schools where the results were better (as in Vulli Valley and Lamplough) teachers also employed more often other methods such as question and answer and games and simulations. From this therefore it can be deduced that a mixture of teaching style helps pupils to understand models better than the use of one style.

## SUMMARY

This chapter has identified the fact that both pupils and teachers perceive some models as being easy while others are just right or difficult. Models that are familiar (often because they exist within the immediate environment of the individual) are

perceived as easy or just right. On other hand most unfamiliar models are perceived as difficult. This perception affects the level of understanding of the models. The chapter has also noted that there are several other factors which affect the level of understanding of models as a result of classroom practices. These are: type of models used, teacher qualifications, level of experience of teachers, infrequent use of models for teaching, and the place of residence of teachers and the frequency of attendance of field trips. These factors make models difficult and reduce the level of understanding of pupils. Through the conclusions from the previous two chapters one can make recommendations for increasing the level of understanding of models. This aspect of the research is to be taken up in the final chapter.

## *CHAPTER SEVEN*

# **CONCLUSIONS AND RECOMMENDATIONS**

### **7.1 Introduction**

This study sought to identify the problems connected with the use of models in Geography textbooks used in the former Transkei. The research was based on the fact that pupils' level of understanding of models in Geography affect both attainment in the discipline and the enrolment of pupils' in the discipline. It is also known that models happen to be found on almost every page of the Geography textbooks and if pupils are to develop an interest in the Geography their level of understanding in them must be increased so as to help improve their performance. While research has been done among the Black population in South Africa to gauge pupils perceptions of Geography (Ballantyne, 1981, Ledger, 1981) no such study employing the techniques utilised in this research exists for models and for the Transkei in particular. This is partly because many of these researchers have not paid equal attention to both nature and nurture in their examination of the factors influencing variations in the understanding of models used in Geography textbooks in the Transkei. This is in spite of evidence of poor attainment and a slower growth rate in pupil numbers in Geography in relation to other subjects studied in the school curriculum. This study, however, attempted to do more than to identify the problems encountered by pupils with selected models in Geography, because it also attempted to isolate the factors which influence the level of understanding generally of models in Geography. With the above considerations in view the research was conducted through the simultaneous consideration of pupils' level of understanding of and attitudes to models as well as teacher attitudes and

of and attitudes to models as well as teacher attitudes and classroom practices. Two instruments were used to identify the problems connected with the understanding of models in the Transkei. The first consisted of a test to assess the level of understanding while the second was an attitudinal probe. The target population consisted of 341 standard eight and nine pupils in four high schools in the Butterworth District of the Transkei. Within the group, differences in the tests and in the information from the questionnaire on attitudes on key variables was obtained. Through the statistical techniques of correlation analysis, Chi-square and factor analysis the major problems connected with the understanding of models were identified. The key factors among these were grouped, and their importance evaluated. The underlying principles of these key factors were then examined. Through using these techniques the following results were obtained.

## **7.2 SUMMARY OF RESULTS**

### **7.2.1 The Major Factors Determining the Level of Understanding of Models**

The application of the technique of factor analysis revealed that variations in the level of understanding of models in the Transkei is mainly due to environmental factors and teaching techniques used by teachers. These factors are also related to several other variables. These work through certain factors and their associated processes. The results of the analyses indicate that problems connected with the use of models are located within and also beyond the school environment. The school problems include teacher practices while the factors beyond the school include socio-economic circumstances which is also related to place of residence. The most important conclusions of the research are the following:

### **7.2.2 The Relationship Between the Variables**

It was observed that strong relationships existed between the level of understanding of the models and some of the selected variables. On the basis of the strength of the relationships between the variables, they were grouped into two. The groups, in order of importance on the basis of their contribution to the variation were: environmental factors (about 54%), and nature (about 38%).

The identification of the relationship between these two groups of factors revealed that among others it was the operation of these distinct groups of factors which influenced the level of understanding of models used in Geography textbooks in the Transkei. These factors were previously not emphasised as to be affecting the level of understanding of the models in Geography with pupils in the Transkei. This study has tried to show in the sample taken that socio-economic factors in particular are having a major effect on the level of understanding of models used in Geography textbooks and on academic achievement generally in Transkeian high schools.

### **7.2.3 The Associated Processes**

The research revealed that the causes of variations in the level of understanding of models in the Transkei, in addition to various factors isolated, are also affected by the association between these factors. These factors include teacher practices, and the place of residence of the pupil. Whilst the environmental factors generated variations in the level of understanding due to variations in socio-economic status, other government-created factors

(both Provincial and National) are responsible for the distinct differences in the level of understanding of models between pupils in urban and rural areas. The research discovered that in spite of the socio-economic effects, the presence of certain factors (eg teacher efforts) greatly reduce the effect of these groups of factors on the level of understanding of models used in Geography textbooks among pupils in the Transkei. For instance it was revealed that, there is a general increase in the level of understanding with the employment of a mixture of teaching styles. Similarly there is a decrease in the level of understanding of the models with infrequent use of them. Level of understanding of models was also shown to be positively related to the level of educational attainment of parents or guardian. The study also reveals that a great deal of perceptions about models is determined - or at least co-determined - by basic socio-economic factors.

It is known that the causal links between the elements can be reduced if not eliminated through intervention. Upon this finding the following recommendations are made which will help to reduce variations in the level of understanding of models used in Geography textbooks in the Transkei and should help many pupils to achieve better results in Geography.

### **7.3 RECOMMENDATIONS**

One problem which emerges from this research is that of understanding human behaviour. Assuming that such a behaviour is based on rationality it then seems that the Max Weber assumption of a means to end relation offers the best possible explanation. This

concept implies that people choose appropriate means to achieve certain ends. It is in this light that certain means are suggested here for the achievement of an end - increased level of understanding of models.

### 7.3.1 Teaching Methods

One important finding of this study is that pupils in the same class in schools in the Transkei constitute widely different ability groupings. There is also the recognition that many pupils due to home background have learning difficulties. Teacher-centred whole class approaches to teaching are therefore often ineffective as the pupils differ markedly in their abilities.

One fundamental way of dealing with mixed ability classes is to lower the number of pupils per teacher. This will permit differentiation and enable a teacher to adopt techniques allowing him to offer individual attention and assistance to his pupils. It is important to recognise in secondary as well as primary education that "all educational processes must start from the present state of the learners ... in terms of readiness, needs, present skills or established knowledge and insight" (Primary Education in the eighties: a COPE Position Paper, p. 3). Teachers must, it is recommended, realise that "the child is the starting-point, the centre and the end. His development, his growth, is the ideal". To this "all studies are subservient" (Dewey, 1992, p.8). This contention behoves on teachers to change their teaching methods and adopt methods that will give recognition to the varied nature of the abilities of the children they teach. This recommendation also implies that the education authorities should make special efforts to reduce the present high pupil-teacher ratio

(especially in the rural areas) so that teachers can give individual attention to the children they have to teach.

The results of this study must also create an awareness among teachers to tackle the problems connected with the use of models. A case can be made on the basis of these results for the screening of teaching materials, for more careful, teaching in the classroom and for raising teacher awareness to the conclusions of this research. It also raises the need for closer supervision of teachers and increased in-service courses for teachers lacking in the knowledge of modern approaches to teaching models in particular.

### **7.3.2 Appropriate Models**

One finding of this research has been that pupils in rural areas do lack an understanding of models partly because of their unfamiliarity. This finding implies that there is a need for the introduction of textbooks with models that will be relevant to pupils of African descent (presenting both rural and urban Africa) and also relevant for second language pupils. While not excluding the need for urban models in Geography classrooms, there is a need for at least the rural models to be based on their experience as rural residents.

### **7.3.3 Length of Time Spent Studying Geography**

One significant finding of this research has been that pupils who have been studying Geography for a shorter time seem to like the discipline better than those who have spent a longer time gaining mastery of it. This finding is at variance with what it should be. If

teaching styles are varied and teaching materials carefully selected, there is no reason why the perceptions of Geography should not improve as one studies it over a longer period of time. Geography teachers, therefore, ought to acknowledge this by examining and seeking improvement in their teaching styles and by employing more stimulating teaching aids.

#### 7.3.4 Socio-Economic Needs

The influence of the environmental factor on level of understanding of models represent an important finding of this study. It has long been suspected that socio-economic status and cultural factors do have a marked influence on academic achievement. The nature and extent of the correlation has however not been explored hitherto in the Transkei. The problem with these two factors relates to the inability to obtain educational materials and consequent educational exposure to them. The acceptance of new ideas by the traditional population is also a major constraint. This problem has been known to be the cause of underdevelopment in several regions (Haggerstrand, 1967). In the Transkei the problem has been traced to the general lack of knowledge, the lack of the means to buy and as a consequence increased ignorance in the use of contraceptives (Thomas, 1985). There is also an unwillingness on the part of people to have smaller families nor to have children at longer intervals. This merits separate consideration in the sub-section following this one.

A comprehensive solution to these problems seems to be related to a general need for upliftment of the living standards of the population. By introducing work opportunities, building more hospitals and clinics especially in the rural areas, extending roads, electricity

and other modern amenities to the rural areas innovations would spread and positive changes would emerge in the life of the people. Gradually the people will be made aware of opportunities that exist for one to enhance themselves and they will come to realise that having many children inhibit this self-improvement. With improved living standards the death rate will also be lowered which will make it unnecessary to have many children. Since more children will be surviving there will be less incentive to have large families. An improvement in living standards will also mean that parents will have surplus income which will permit them to save enough to provide for their future. They therefore will not need children as a sort of unemployment insurance in their old age. Lastly, improved incomes will permit parents to afford many other material benefits (television sets, radios, etc) which help in their child's education but which for lack of funds and time schools are unable to provide.

#### **7.3.5 Public Enlightenment on Family Planning**

Public enlightenment programmes could be introduced so that people are made aware of the existence of family planning clinics. In this connection the introduction of radio programmes that will discuss the use, importance and the availability of contraceptives will be most welcome. Printed matter could be used to supplement the radio programmes. Personal contacts will also be needed to motivate the learners and reinforce the message. The public enlightenment programmes can be issued along with the pension payments. It is known from field observations that on the days when pensions are to be paid many people gather near the place where it is to be paid and many traders take advantage of it to sell their wares. Government health officials could go with those paying the

pensions, talk to the people about contraceptives, distribute some free samples to them as well as giving them information on how to use them. Use could also be made of the traditional authorities in the spread of ideas. The importance of traditional authorities in rural areas gives them a unique role in the spread of new ideas as has been realised by others (Tuan Ti Fu, 1971). Once such authorities have been introduced to contraceptives their help can be solicited to help others to get to know about them and to use them as well. In the towns, advertisements in the local papers or on bill boards will be most helpful as a supplement to radio and television (as is now the practice in Botswana). A mass media educational programme using both local staff and printed matter will achieve more for the project. The message that should be stressed is that contraceptives will help to space the children and facilitate a better academic achievement and not to stop parents from producing children.

Efforts in this regard can also be directed to the upliftment of women. From field observations it does not appear that women are discriminated against in their freedom to attend schools. However, there is a need to open more avenues for women to work in the fields traditionally reserved for men. Women in the Transkei mostly work as teachers or nurses. Very few work in the upper echelons of the public service. The problem with the shortage of women in such fields relates to prejudices held against them by men and their commitments as mothers which leaves many of them with very little time to study further in order to qualify for high level jobs.

There is therefore a case for special education and job programmes for women. In view of the fact that they form the majority of household heads in the Transkei their education will have a greater impact on the level of understanding of the models and increase the academic achievement of the pupils. Special bursaries should be offered to women to induce them to stay longer at school. Increased education of women will lower the birth rate. This is because the age at which women can give birth is limited so more years spent in school will leave fewer for child-bearing. With increased education women will also come to know about contraceptives and to realise that spacing their children is good for their own health and the academic achievement of their children. Special job programmes should also be offered to them in the fields traditionally reserved for men such as in the armed forces. In time this will help people to realise that there is no exclusivity about male/female occupations.

#### **7.3.6 The Use of the Mass Media**

The availability of radios and television sets in a home has been noted through this research to influence levels of understanding of models. Government efforts at helping people to acquire these assets either through loans or lowering the tax on these will encourage many people to acquire these assets. The television companies can also acknowledge the influence of these in their planning of programmes. More educational programmes will be helpful in improving the levels of understanding of models and consequently improve academic achievement.

### 7.3.7 Adult Literacy

The negative influence of illiteracy on the academic achievement of pupils represent one area that should be of national concern. This particular problem has been realised and there exist adult literacy programmes in the country. However the number of candidates as compared to the many people who need the programme is very insignificant indeed. If more money could be made available, the project could be expanded and more people catered for. There is also the need for effective supervision of the project so that benefits are realised in the shortest possible time.

In the short term the problem of raising extra money could be overcome by making use of senior students on holidays for crash courses for illiterate adults in reading and writing. Thus in time illiterate adults will become aware of the benefits of education and will motivate their children to set high standards in academic achievement for themselves. The Radio could also be employed as part of the adult literacy programme. This is a realistic approach in view of the widely dispersed nature of rural population in the Transkei.

To ensure proper co-ordination and supervision of the project it is necessary that a single entity must control the project including the training and administration of the field staff. As much as possible local human resources should be used in the project.

### 7.3.8 Job Creation

The biggest problem with the soio-economic factors relates to unemployment. Of a total labour force of one million Muller (1983a) estimates that only one fifth are employed. It is not surprising therefore that internal employment is dwarfed by labour migration. While migration provides one means of solving the unemployment problem it has been found to have a negative influence on pupils' academic achievement. The key to the solution of the unemployment problem seems to lie in agricultural development. The availability of land is the most restraining factor in this regard (Nkuhlu, 1986).

Land allocation should be streamlined to cut red-tape so that many people with capital can farm. Agriculture while giving people work will also keep them in the rural areas and therefore reduce the migration rate if not eliminate it. It will finally afford many children the opportunity of staying with their parents. As a consequence their intellectual development will be improved and hopefully also their level of understanding of models used in Geography textbooks.

### 7.3.9 Income Distribution

Government action seems to be the principal cause of inequality of income distribution between rural and urban areas. Government can reverse the trend by making sure that rural residents receive fair prices for their produce. Attempts should also be made to provide rural residents with cheap credits so that they will be able to increase their output. Extension offices should also be offered to farmers to teach them proper techniques of

production which will lead to increased output. With increased output farmers income will be improved and the income inequality reduced. Through this many people will be able to afford staying with and looking after their children. They will also be able to buy the necessary educational materials for their children thereby helping to improve their academic performance and in the end help to lower the variations in the level of understanding of models used in Geography textbooks in the rural as compared to the urban areas.

#### 7.3.10 Data Bank

The acute shortage of data on vital matters in the former Transkei inhibit successful planning and implementation of programmes today. Government should, as a matter of urgency, establish an agency whose sole responsibility will be the gathering of data on socio-economic indicators in the Transkei. This will greatly facilitate the drawing up of programmes and their implementation. Problems will therefore be known at early stages and they can be tackled with an indepth understanding of their nature.

Finally, it will be worthwhile for researchers to devote attention to the relationships between socio-economic factors and academic achievement. For example researchers are needed to indicate the precise number of socio-economic indicators that affect academic achievement. Through such work the real impact of socio-economic factors on academic achievement will be known and plans drawn up to deal with the problems they pose. The information could also be used to provide various models and plans which could help to improve the academic achievement of school pupils in the Transkei and elsewhere.

Education has a role to play in the development of the country and the identification and removal of the various factors that inhibit it could help in speeding up the development of the country.

Increased development of the region will ensure stability and progress for all in the whole country. Improved academic achievement among pupils will be one means of achieving this. It is hoped therefore that this work and others to follow will shown the way to this goal.

## **7.4 FUTURE AREAS OF RESEARCH**

### **7.4.1 Relationships Between Academic Understanding and Socio-Economic Factors**

This study has revealed that there are fundamental relationships between pupils' academic achievement (as indicated by their level of understanding of models) and their socio-economic conditions. The nature of the relationship has been indicated for models in Geography. There is a need to build on this and to examine the relationship between socio-economic conditions and pupils' academic achievement not only for the other areas of Geography but also for other disciplines. This will serve to increase understanding and be useful to teachers in the design of their teaching techniques. The results of such studies would be helpful in syllabus design, teaching methods. Such studies can also help to supplement and refine the findings in this study.

#### **7.4.2 The News Media Factor in the Understanding of Models**

One significant finding of this research has been the fact that the frequency of newspaper reading and of listening to the radio news has a major influence on the level of understanding of models in Geography. The factors responsible for these were, however, not examined at any length in this research and would seem to be an important area for further research. Such a work could extend the findings in this study to other curricular areas.

#### **7.5 CONCLUDING COMMENTS**

The purpose of this study was to investigate through the use of a questionnaires and tests the problems encountered by school pupils in the understanding of models used in Geography textbooks in the former Transkei. The results suggest that the null hypothesis (Chapter Three) that the distribution of group responses to each individual item would be identical does not appear to be entirely true. The alternative hypothesis that the distribution of group responses to items in the questions indicate shifts in the response locations is more acceptable. Problems were related to both school and home. The results also indicate that the level of understanding of models are strongly related to the socio-economic background of the respondents and to the school environmental conditions. The results of the study hold major implications for teachers, educational planners and supervisors and to the organisers of in-service courses for teachers. Teachers could, for instance, use the techniques utilised in this research to determine the level of understanding of their pupils towards models used in Geography or any other discipline in relation to a particular topic or concept. Educational planners and in-service organisers could also encourage teachers to seriously consider the

findings and the conclusions of this research. It is vital that all teachers should evaluate critically their pupils' understanding of a particular concept or topic and their own teaching techniques. The former Transkei badly needs to experience the objectives of the Reconstruction and Development programme in the new South Africa. It is sincerely hoped that this study will have helped to focus attention on some of the educational and socio-economic needs that must be addressed.

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## Appendix A - Sample of Questionnaire for Pupils

### A SURVEY OF PUPILS' UNDERSTANDING OF THEORETICAL MODELS

You have been selected as part of a group of pupils to take part in a survey. The purpose of this survey is to collect information about pupil's understanding of theoretical models used in Geography textbooks. Answer each question as you feel. Your name is only required for the purpose of analysis.

#### SECTION A : PERSONAL DETAILS

---

Please answer every question with a tick of the appropriate response.

For example :-

(a) Male                      (b) Female

Thank you for your co-operation.

---

Name : .....

1. Sex (1) Male            (2) Female
2. Age
3. For how many years have you been studying Geography ?  
None 1 2 3 4 5 6 7 8 9 10 11 12
4. Have you ever been on a Geography Excursion ?  
(1) Yes            (2) No
5. Level of Education of Head of Family  
(1) No formal Education (2) Primary Education  
(3) Std. 8    (4) Matric    (5) Post Matric  
(6) University Education
6. Do you ever get help from your parents with your school work ?  
(1) Yes            (2) No
7. How often do you read newspapers ?  
(1) Daily    (2) Once a week    (3) Seldom  
(4) Never
8. How often do you listen to the radio news ?  
(1) Regularly    (2) Sometimes    (3) Seldom  
(4) Never
9. How often do you watch TV ?  
(1) Regularly    (2) Sometimes    (3) Seldom  
(4) Never
10. Did you study Geography in the primary school (std 1,2,3,4) (1) Yes    (2) No
11. Did you study Geography in the Junior secondary school (std. 5,6, and 7). (1) Yes    (2) No
12. Did you start Geography in only Standard Eight  
(1) Yes            (2) No

SECTION B

ATTITUDES TOWARDS MODELS

---

1. Do you like Geography ?
2. Indicate how often you refer to models when reading a Geography textbook by ticking the appropriate response  
(1) very often (2) often (3) sometimes (4) not very often  
(5) never
3. Do you find them helpful ?
4. Can you understand them by yourself or do you need the teachers help ?
5. Do you ever practice drawing models at school ?
6. Does drawing models in other subjects help you ?
7. Which subjects for instance .....
8. Have you any suggestions which would help you in understanding models

QUESTION ONE

Instructions: Study the diagram below (Fig. 1) and answer the questions that follow. Answer all the questions.

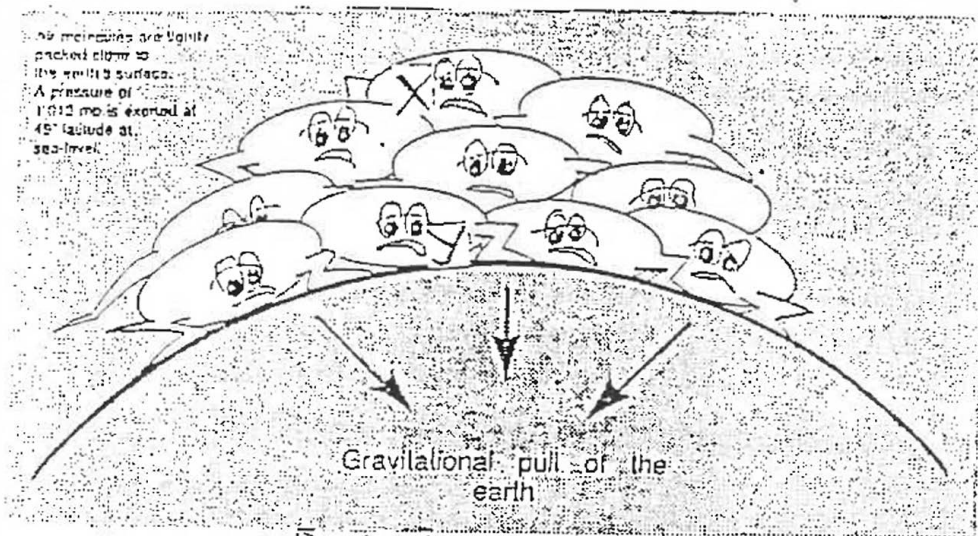


FIG 1

1. What is represented by the arrows in the diagram ? (2)
2. What effect does the force of gravity have on the air molecules ? (2)
3. Which has the highest altitude X or Y ? (1)
4. Where is the gravitational pull greatest is at X or Y ? (1)
5. Where is it least X or Y ? (1)
6. Why is it greatest at X or Y and least at X or Y ? (4)
7. Why are there 4 faces closer to the earth's surface, than 3, 2 as you move up in the diagram ? In other words, why do the faces get lesser and lesser as you move up ? (2)
8. In the model it is stated that at 45° latitude an air pressure of 1013mb is exerted at sea level, that is at 0 metres altitude. At 45° line of latitude and 625 metres altitude the air pressure is 915mb. From what you have learnt from the diagram can you give a reason for these differences in air pressure at these different altitudes ? (3)
9. The moon which is smaller than the earth and closer to the earth, does not have an atmosphere. Can you give the reason for this ? (2)

QUESTION TWO

Instructions: Study the diagram below (Fig. 2) and answer the questions that follow. Answer all the questions.

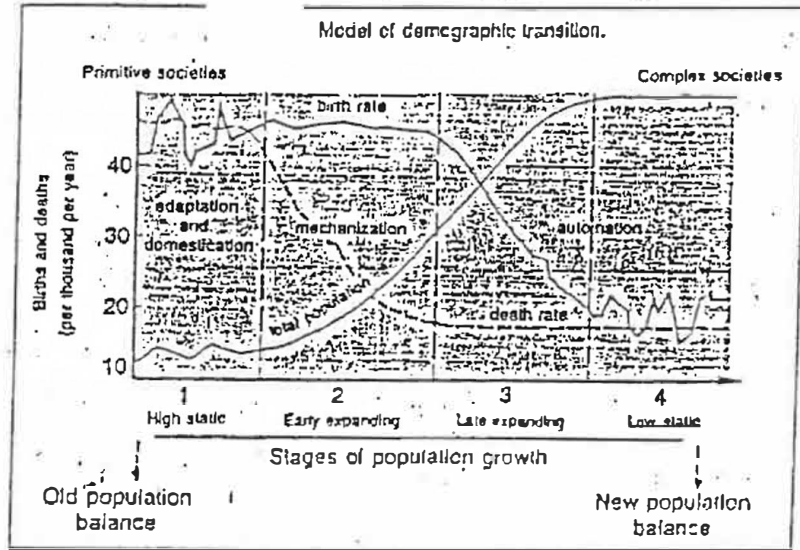


FIG 2

1. What do you understand by the following words used on this diagram :
  - (a) model of demographic transition (2)
  - (b) primitive society (2)
  - (c) complex society (2)
  - (d) stage of adaptation (2)
  - (e) stage of automation (2)
  - (f) population balance (2)
  - (g) high static (2)
2. Why is it important to read the graph from left to right ? (2)
3. Why is there a decline in the birth rate and death rate during the late expanding stage ? (2)
4. What effect does the decline in birth rate and death rate have on population growth ? (2)
5. Compare the primitive societies with the complex societies under the following headings :
  - (a) birth rate (2)
  - (b) death rate (2)
  - (c) population growth (2)
6. Supposing Transkei was in the late expanding stage of population growth how would it be with regard to :
  - (a) birth rate (2)
  - (b) death rate (2)
  - (c) population growth rate. (2)

[32]

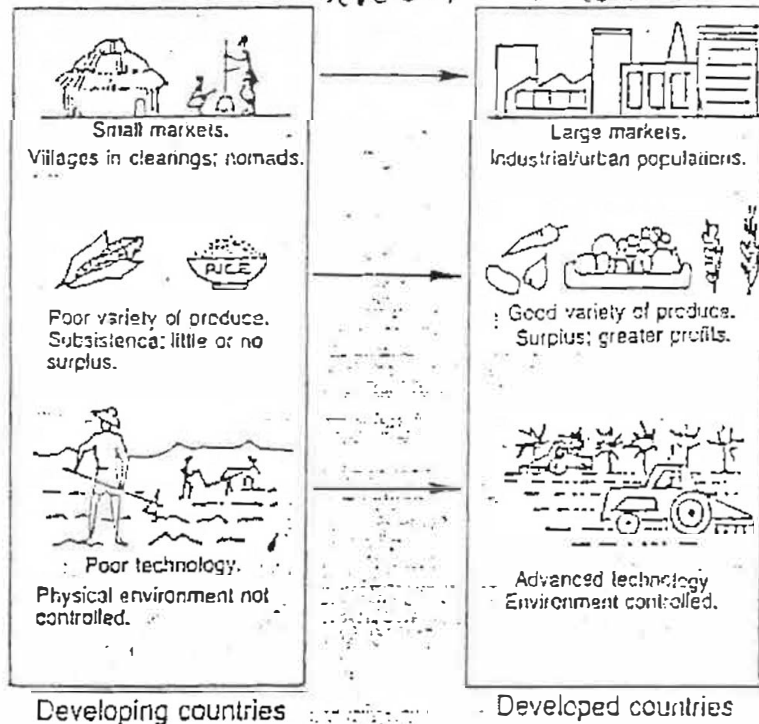


## QUESTION FOUR

Instructions: Study the diagram below (Fig. 4) and answer the questions that follow. Answer all the questions.

### AGRICULTURE SYSTEMS IN DEVELOPED AND DEVELOPING COUNTRIES

FIG. 4



1. Use the above picture diagram to compare developing countries with developed countries. How do developed countries differ from developing countries in connection with the following :
 

(a) The size of markets	(4)
(b) Location of markets	(4)
(c) The variety of crops	(4)
(d) Market prices	(4)
(e) Surplus	(4)
(f) Level of technology	(4)
(g) Yield per hectare	(4)
  
2. Can you say anything more about the following with respect to both developed and developing countries: Does anything in the pictures or words in the diagram help you in explaining these ?
 

(a) soil fertility	(4)
(b) pest control	(4)
(c) water supply	(4)
(d) storage facilities	(4)

[44]

## QUESTION FIVE

Instructions: Answer all the following questions.

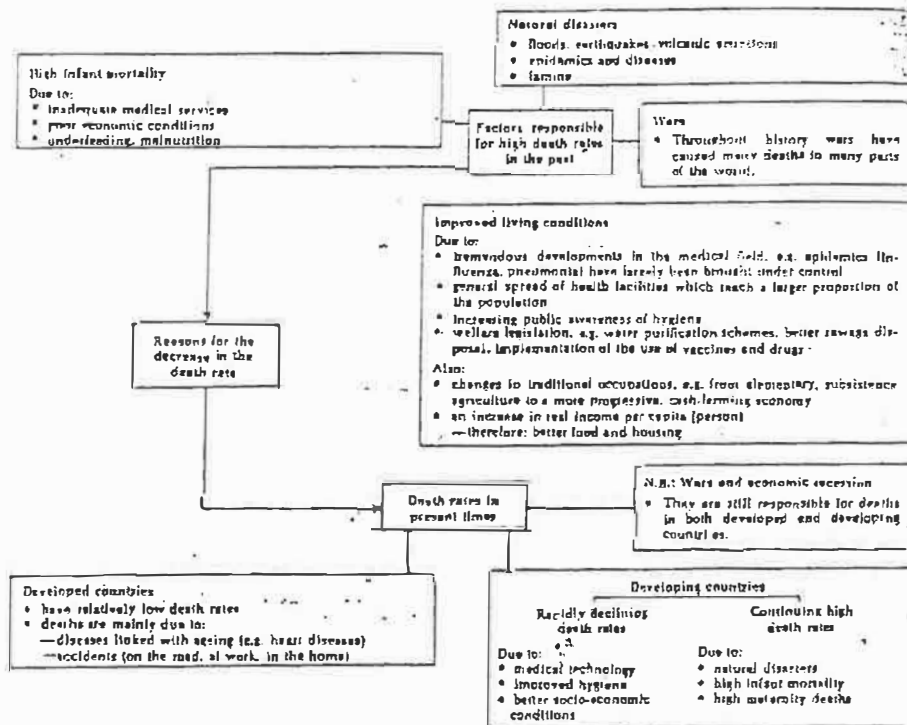
### MODELS OF URBAN STRUCTURE

1. According to Burgess, Hoyt, Harris and Ullman, urban areas have land-use zones. Name the three main land-use zones they talk about. (6)
2. These men produced models of urban structure. These are :  
(a) the concentric model (b) the sector model (c) the multiple-nuclear model. Make a sketch of each, to show the different ways in which a town structure might grow. (9)
3. Do you think that a town or city will always grow in one of these patterns ? give a reason for your answer. (3)

[18]

## QUESTION SIX

Instructions: Study the diagram below (Fig. 5) and answer the questions that follow. Answer all the questions.

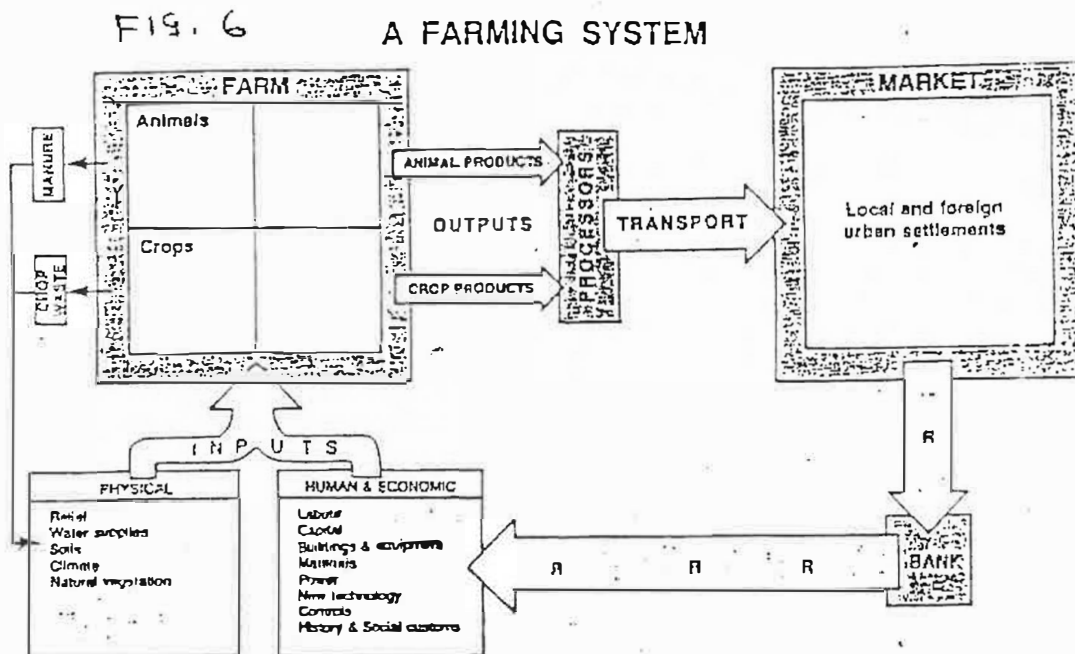


1. List two causes of death in the developed countries and two in the developing countries. (8)
2. What effect has improvement on health facilities had on the death rate? (2)
3. How can the death rate in developing countries be reduced? (2)
4. How has an increase in real income per capita influenced the decrease in death rates? (2)
5. State one way in which the infant mortality rate can be reduced? (2)
6. Give one reason why developed countries have low death rates as compared to developing countries? (2)

[18]

## QUESTION SEVEN

Instructions: Study the diagram below (Fig. 6) and answer the questions that follow. Answer all the questions.

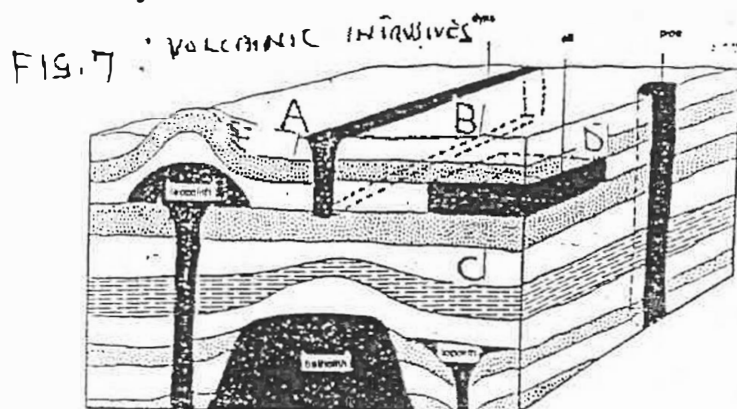


1. What products are obtained from the farm ? (2)
2. What happens to the farm products before they reach the market ? (2)
3. How do the processed products reach the market ? (2)
4. How does climate influence activities on the farm ? (4)
5. In what form does the waste leave the farm ? (2)
6. What happens to the waste material that leaves the farm ? (2)
7. How do you think that money from the bank might affect buildings and equipment ? (2)
8. What contribution does the bank make to the farming system ? (2)

[18]

## QUESTION EIGHT

Instructions: Study the diagram below (Fig. 7) and answer the questions that follow. Answer all the questions.



1. This diagram represents what is happening on the earth surface and below the surface. In the diagram which of the places marked by the letters A,B,C,D are on the surface and which are below the surface ? (4)
2. In what way is this diagram similar to a brick ? (2)
3. Why are the features shown in this diagram called "intrusives" ? (2)
4. Draw simple sketches of how (i) a dyke, and (ii) a sill would look like if taken out of this diagram and drawn separately on their own. (6)
5. Match the features shown in the diagram with the description that best suits them by inserting the number of the description opposite the correct letter eg a = 2.

Feature	Description
(a) Lava flow	1. A mushroom shaped intrusion (1)
(b) Laccolith	2. Horizontal feature, parallel to layers of rock (1)
(c) Lopolith	3. Igneous intrusion that cuts across layers of rock (1)
(d) Dyke	4. Saucer-shaped intrusion (1)
(e) Sill	5. Outpouring on the surface through a large crack (1)
	6. The largest of the intrusive forms (1)

6. Make a similar diagram of a rift valley and a block mountain. (6)

[25]

QUESTION NINE

Instructions: Answer all the following questions.

1. The following terms are taken out of models found in standard 6, 7 and 8 textbooks. Explain what is meant by each term or word:

- (a) strata (2)
- (b) aggradation (2)
- (c) insolation (2)
- (d) commuter zone (2)
- (e) diversified (2)
- (f) orogeny (2)
- (g) nocturnal (2)
- (h) terrestrial radiation (2)
- (g) depression (2)
- (h) sediment (2)

[20]

2. Using the following numbers to represent degrees of understanding (as indicated below) :

- 1. understand it all
- 2. understand more than half
- 3. understand less than half
- 4. Don't understand any

arrange the models dealt with in this test in order of difficulty by making a tick at the appropriate column.

MODEL	LEVEL of UNDERSTANDING			
	1 ALL	2 < HALF	3 > HALF	4 NONE
A. Gravitational pull of the earth				
B. Model of demographic transition				
C. The structure of the atmosphere				
D. Agricultural systems in developing and developed countries				
E. Models of urban structure				
F. Factors influencing the crude death rate				
G. A farming system				
H. Volcanic intrusives				

Appendix C - Sample of Questionnaire to Teachers on their Attitudes to Models

FOR GEOGRAPHY TEACHERS  
QUESTIONNAIRE ON THE USE OF MODELS

INSTRUCTIONS:

- 1 Kindly put a tick in the box next to the chosen answer.
- 2 Choose ONE answer, unless stated otherwise.
- 3 Please raise your hand if there is something you do not understand.
- 4 Please do not discuss the questions with other teachers.

--	--

1 - 3

SECTION A  
PERSONAL DATA

For Official  
use only

1 Sex:

Male

	1
--	---

Female

	2
--	---

--

4

2 Academic Qualification:

Matriculation

1
---

B.A.

2
---

B.Sc.

3
---

B.Ped.

4
---

B.A./B.Sc. Education

5
---

B.Ed.

6
---

M.A./M

7
---

M.Ed.

8
---

D.Ed./Ph.D.

9
---

--

5

.../2

3 Professional Qualification for Teaching:

None	1
N.P.L.	2
N.P.H.	3
P.T.C.	4
J.S.T.C.	5
S.T.D.	5
Undergraduate University Diploma	7
Post Graduate University Diploma	8

	6
--	---

4. At your College or University, did you receive any training in geography teaching?

Yes	1
No	2

	7
--	---

5 Highest standard trained to teach:

Std 5	1
Std 6	2
Std 7	3
Std 8	4
Std 9	5
Std 10	6

	8
--	---

6 Highest geography standard taught in 1989

Std 5	1
Std 6	2
Std 7	3
Std 8	4
Std 9	5
Std 10	6

	9
--	---

7 Number of years teaching geography:

0 - 1	1
2 - 3	2
4 - 7	3
8 - 11	4
12 - 15	5
Over 15	6

10

8 On appointment to your present school, were you interested in:

Teaching geography only	1
Teaching geography and one other subject	2
Teaching geography and more than one other subject	3

11

9 If you had the choice, would you prefer not to teach geography:

Yes	1
No	2

12

### SECTION B

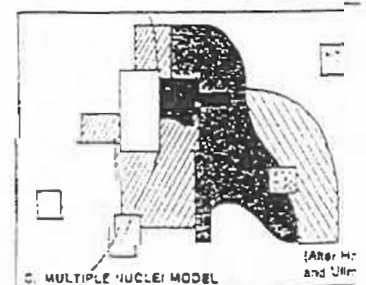
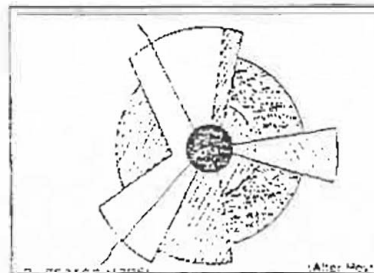
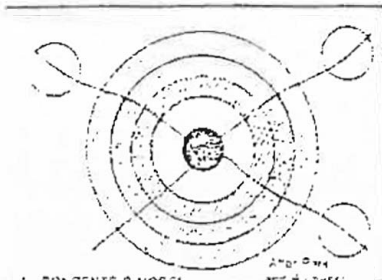
#### ATTITUDES TO MODELS

The world is too complex for man to understand easily. Models are used with the purpose of simplifying reality for easier study and understanding. The following are examples of models taken from Standard 7 and Standard 8 textbooks:

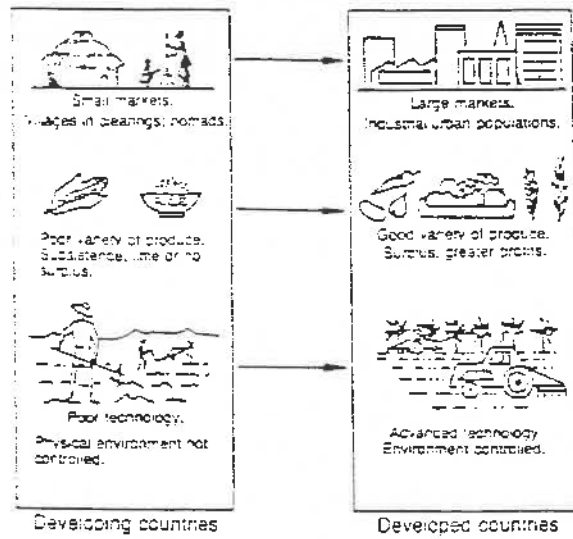
##### Model 1

Here are some standard models of urban structures. They show how land is used and occupied in urban areas. The models also show how land occupation and land-use are related.

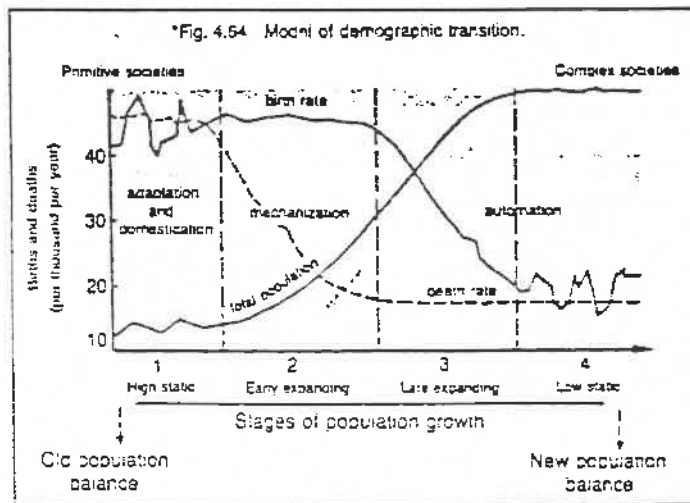
- Central business district
- Warehouses, light industry and slums
- Low income residential
- Middle income residential
- Upper income residential
- Heavy industry
- Subsidiary business districts
- Commuter zones



Model 2



Model 3



Model 4

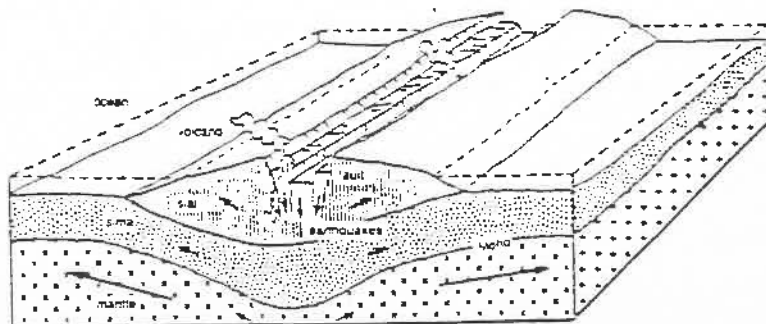


Fig. 3.154-2 Rift valley.

10 Which of the models shown above do you think are easy for pupils and which ones do you think are difficult? Please rank them in order of difficulty for pupils by putting (1) next to the most difficult; (2) next to the second most difficult. etc.

Model No 1	<input type="text"/>	<input type="text"/>	13
Model No 2	<input type="text"/>	<input type="text"/>	14
Model No 3	<input type="text"/>	<input type="text"/>	15
Model No 4	<input type="text"/>	<input type="text"/>	16

11 Which of the models given above do you think are useful for teaching? Rank them in the order you think they illustrate the concepts they present. Put (1) next to the one you think is the most useful for teaching; (2) next to the second most useful. etc.

Model No 1	<input type="text"/>	<input type="text"/>	17
Model No 2	<input type="text"/>	<input type="text"/>	18
Model No 3	<input type="text"/>	<input type="text"/>	19
Model No 4	<input type="text"/>	<input type="text"/>	20

12 Indicate by means of a tick the extent to which you agree or disagree with the following statements:

1 "The number of models in geography textbooks should be reduced."

- (1) Agree strongly
- (2) Agree
- (3) Undecided
- (4) Disagree
- (5) Disagree strongly

<input type="text"/>	21
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12.1 "Models waste a lot of teaching time."

- (1) Agree strongly
- (2) Agree
- (3) Undecided
- (4) Disagree
- (5) Disagree strongly

<input type="text"/>	22
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12.3 "Pupils find models difficult."

- (1) Agree strongly
- (2) Agree
- (3) Undecided
- (4) Disagree
- (5) Disagree strongly

23

12.4 "I prefer a book with a lot of models."

- (1) Agree strongly
- (2) Agree
- (3) Undecided
- (4) Disagree
- (5) Disagree strongly

24

12.5 "Teaching models is difficult."

- (1) Agree strongly
- (2) Agree
- (3) Undecided
- (4) Disagree
- (5) Disagree strongly

25

12.6 "The use of models like Model 1 makes urban geography easier to understand."

- (1) Agree strongly
- (2) Agree
- (3) Undecided
- (4) Disagree
- (5) Disagree strongly

25

12.7 "The use of models like Model 2 makes development geography easier to understand."

- (1) Agree strongly
- (2) Agree
- (3) Undecided
- (4) Disagree
- (5) Disagree strongly

27

12.8 "The use of models like Model 3 makes population geography easier to understand."

- (1) Agree strongly
- (2) Agree
- (3) Undecided
- (4) Disagree
- (5) Disagree strongly

23

12.9 "The use of models like Model 4 makes geomorphology easier to understand."

- (1) Agree strongly
- (2) Agree
- (3) Undecided
- (4) Disagree
- (5) Disagree strongly

	29
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SECTION C

HOW MODELS ARE USED IN THE CLASSROOM

13 Do you think that models should be used with pupils in the senior primary school?

Yes	1
No	2

	30
--	----

14 Do you use 'hardware' models with your class?

Yes	1
No	2

	31
--	----

15 If yes, do you let pupils build their own 'hardware' models?

Yes	1
No	2

	32
--	----

16 How often do you take pupils out on a fieldtrip?

Once a month	1
Once a quarter	2
Once in six months	3
Once a year	4

	33
--	----

17 When on a fieldtrip, do you encourage your pupils to test particular models, like Models 1 and 4, against reality?

Yes  1  
 No  2

34

18 Please indicate how frequently you use the following teaching methods- Please circle your choice.

- (1) Never
- (2) Very seldom
- (3) Seldom
- (4) Often
- (5) Very often

<u>METHODS</u>	<u>LEVELS OF FREQUENCY</u>					
	1	2	3	4	5	
'Teacher talk'						35
Group discussions						36
Question and answer						37
Practical work						38
Models						39
Fieldwork						40
Games and simulations						41

I would much appreciate the opportunity to discuss the teaching of models with geography teachers in the Southern Region of Transkei. Would you be prepared to spare my half an hour at your school? I will telephone you to make an appointment.

Are you, therefore, prepared to discuss the teaching of models with me?

Yes  1  
 No  2

42

PTO

If you are prepared to discuss the teaching of models with me, please fill in your name, address and telephone number below:

Name: .....

Address: .....

.....

.....

Telephone No: .....

Thank you for your co-operation.

N Ntikinca  
Butterworth College of Education  
P O Box 311  
BUTTERWORTH

Telephone No: 4627

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