

AN ANALYSIS OF TEACHERS' METHODS  
OF TEACHING NUMERACY SKILLS  
IN STANDARD 10 GEOGRAPHY  
IN THREE SCHOOLS IN  
EASTERN CAPE  
PROVINCE.

BY

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## DECLARATION

I hereby declare that this dissertation represents my original work and has not otherwise been submitted in any form for any degree or examination to any University. Where use has been made of the work of others, it is duly acknowledged in the text.



M.M.MBUCE



DATE

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## ABSTRACT

This study aimed at investigating the methods used by teachers to assist the acquisition of numeracy skills by Standard 10 Geography learners. The problem of high failure rate in these skills was considered in terms of Perkins' (1992) minimum conditions for learning which, according to him, could assist and improve learner performance. These are : clear information, thoughtful practice, informative feedback and strong motivation. This investigation also draws upon Gallimore and Tharp's (1991) means of assisting performance in the zone of proximal development, which include modeling, contingency management, feeding back, instructing, questioning and cognitive structuring.

Data was collected by means of a number of lesson observations in three senior secondary schools in the Eastern Cape Province. This data was analysed in terms of whether or not teachers included Perkins' (1992) minimum conditions for learning in their methods of teaching and whether or not teachers used Gallimore and Tharp's (1991) means of assisting performance in their teaching activities.



The overall result of the investigation indicated the overuse of the lecture method and the “recitation script” which denied learners opportunities to participate actively in the lesson. This research indicated, therefore, that the methods used by teachers in teaching Geography numeracy skills did not contribute towards the improvement of the learners’ performance. A number of suggestions are made regarding initial and in-service teacher education and the encouragement of research by teachers into their own professional practice.

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## **CHAPTER 1 : INTRODUCTION**

### 1.1 THE TRADITIONAL FORM OF TEACHING IN SOUTH AFRICA.

From the pre-democratic era in South Africa to the present moment, teaching in the schools, the former Department of Education and Training (DET), Transkei, Bophuthatswana, Venda and Ciskei (TBVC), Indian, Coloured and White schools inclusive, have been traditionally oriented in terms of the mode of teaching. This traditional form of teaching was characterized by a content based instruction which was based on a part-discipline of education called General Didactics, a component of Fundamental Pedagogics. This General Didactics, which dominated teacher training, focused its attention on effective ways of transmitting knowledge and skills and on general principles of teaching which would be valid and uniform for all subjects and all schools (Duminy 1976:05).

This form of teaching, the “recitation script” (Gallimore and Tharp 1991:175), contributed to a general trend which schools followed. Such a form of teaching was characterized by a “dosage of instructions” in the classroom, and verbatim memorization of unrelated facts (ibid: 175). This approach to teaching was often based on rote-learning of the content, as that seemed to be the only way in which teachers felt they could cope with the mass of information they were expected to impart to their learners. In this way, the learners depended on the teachers' directives to gain knowledge. Schools relied on this approach to teaching since rote learning became an easy route to the achievement of good results in

examinations which tested only recall of factual information. As teachers were developed through their training to be transmitters of information, learners became uncritical, passive recipients of teacher-directed information and content memorizers who reproduced information for tests and examinations. Such a modus operandi was enforced in all the departments of education and therefore perpetuated a traditional approach to teaching which aimed at the acquisition of content.

Lambert (1994:67) contends that “such education is concerned about conformity rather than change, it is concerned with accepted knowledge”. The effect of this approach to teaching has resulted in a situation in which “...days spent in schools can be demoralizing , demeaning and soul-destroying.” ( Wheldall and Glynn : 1989 :01).

## 1.2 THE PROBLEMS IN STANDARD 10 GEOGRAPHY MAP AND PHOTOGRAPH SKILLS.

Listed herewith are problem areas which caused the Standard 10 Geography students to fail in their application of numeracy skills. These weaknesses are taken from the annual <sup>literature review</sup> examiners reports which persistently exposed a high failure rate in Geography map studies and aerial photograph interpretation. This annual evaluation of Geography results mirrored the insufficiency in learners' achievement and performance. In spite of the annual departmental exposition of the learners' weaknesses in certain areas of map and photograph studies, the learners are demotivated and continue to reveal the same weaknesses.

The areas in which learners experienced difficulties over six years (1991-1995) of evaluation include the following :-

(a) Map studies.

- (i) The use of scale.
- (ii) The use of grid reference.
- (iii) Calculation of magnetic declination.
- (iv) Calculation of time travelled in relation to map distance.
- (v) Calculation of bearings.
- (vi) Calculation of the distance between two points on a map.
- (vii) Calculation of the area of a map.

(b) Photograph interpretation.

- (i) Numbering on air photograph.
- (ii) Calculation of distance on a photograph.
- (iii) The use of scale.

### 1.3 THE PLAN OF ACTION.

In terms of the planned action for this research, the researcher made his point of departure from the premise that the high failure rate in Geography numeracy skills was due to the failure of teachers to vary their methods so that certain requirements for effective learning are met. These requirements are dealt with in the next chapter. Moreover, in order to

investigate the presence or not of such requirements, it was imperative that the researcher observed lessons in which the teaching of these skills took place. This constituted data necessary for this research. If the collected data justified the researcher's assumption, suggestions would be made in an attempt to make the teaching of Geography numeracy skills effective.

In an attempt to bring about effective education for a New South Africa, the Department of Education has introduced a new outcomes-based programme of education termed Curriculum 2005. In this new curriculum framework, "the emphasis will be on what learners should know and can do at the end of the course learning and teaching ..."(Department of Education 1996:02). In this outcome -based education, the specific outcomes signify the end-product of the learning process. This includes skills and knowledge necessary for that particular context.

The autonomous learning desired of the learner does not suggest the negation and neglect of the obligatory role of the teacher- that of teaching and guiding the learners to acquire skills and information in the classroom. In the outcome based education, teachers will be afforded opportunities of implementing many programmes for the production of variety of outcomes. This means teachers will continue to provide support for learning to take place and effective methods of teaching will be more necessary than ever. Curriculum 2005 encourages skills development, and replaces the examination oriented system of education which has dominated general thinking in education up until now. Emphasis will be placed

on knowledge that must be taught against the background of skills to be achieved so that the learners will develop into autonomous and self-regulated learners. Nunan (1989:29) maintains that for the learners to be managers of their own learning, teachers need to teach children how to:-

- \*handle vast amounts of information
- \*develop skills in learning how-to-learn
- \*discover answers for themselves
- \*order and classify information.

#### 1.4 THE LAYOUT OF THE DISSERTATION.

The dissertation comprises six chapters, which are consistent with the steps to be taken in conducting research. The main purpose of this introductory chapter is the general statement of the problem which leads to the analysis of the problem areas in Standard 10 Geography numeracy skills. Chapter 2 is concerned with the purpose of research which guarantees its worthiness of investigation. It is in this scope that the nature of the numeracy skills and the learning programmes in the field of Geography are described. Chapter 3 consists of a number of theoretical contributions that are related to the nature, the teaching and the learning of Geography numeracy skills. This includes research findings and expert opinions derived from the relevant literature, which is related to the problem under investigation.

Chapter 4 discusses the research methodology and procedures. It includes the methodological aspects that are related to the classroom observation of Geography

numeracy skills. This involves an analysis of different approaches to classroom observation with a view to selecting the most appropriate approach for undertaking this research design. It includes an explication of the method used in conducting the research and the setting in which the study was undertaken.

Chapter 5 involves an analysis and the interpretation of lesson observation in terms of Perkins' minimum conditions for learning (1992) and the six means of assisting performance as advocated by Gallimore and Tharp (1990). Chapter 6 consists of the summary of the investigation, implications of the findings and the limitations of the study. This chapter ends with recommendations for further research and conclusions are drawn from the findings.

## **CHAPTER 2 :THE BEGINNINGS OF THE INVESTIGATION.**

### **2.1 THE PURPOSE OF THE INVESTIGATION.**

The purpose of this research was to examine and analyse the methods used by the teachers to assist the acquisition of numeracy skills by Standard 10 Geography learners. The investigation was undertaken within the theoretical framework of Perkins' (1992) as the main consideration. Perkins (ibid) provides four minimum conditions for the learning, namely: clear information, thoughtful practice, informative feedback and strong extrinsic and particularly intrinsic motivation. The investigation also draws upon Gallimore and Tharp (1991) who advocate a theoretical framework based on Vygotsky's theory of education. Such a theory of education contends that the development a child cannot be understood by a study of the individual but through the examination of the external social world in which he or she lives. This implies that when the learners are assisted in their performance, their social interactions must be considered. This framework includes six means of assisting learners' performance in their zones of proximal development namely, modeling, contingency management, feeding back, instructing, questioning and cognitive structuring.

The aim was to investigate whether or not the teachers were meeting Perkins' (1992) minimum conditions of learning and using any of Gallimore and Tharp's (1991) six means of assisting performance in the zone of proximal development during their teaching activities. The assumption was made that teaching which did meet these requirements

would be superior than that which did not, and that failure to meet some or all of Perkins' criteria would be expected in classrooms where learners were performing very poorly in Geography mapwork skills. The teaching of numeracy skills involves the application of quantitative techniques as specific outcomes after learning the progress in part or in whole. Such a study had to evaluate both the teachers' teaching and the learners' learning.

In an attempt to improve geographic education in schools, Hickey and Bein (1996:118) of the Indiana University of Pennsylvania in Indiana introduced a model of teaching cases in which teachers deal with students' learning difficulties during the course of teaching. Their research investigated how students learnt geographic concepts, the source of learning difficulties and what teachers could do to help deflect those difficulties. "Each teaching case included information on learner characteristics, instructional objective, the instructional techniques, a description of learner(s) misunderstandings, the teachers attempt at reteaching or remediation, and relevant demographic data." Hickey and Bein (ibid).

Hickey and Bein (ibid) also contend that to counteract the learners' difficulties in understanding Geography concepts and to assist teachers to teach Geography effectively, they must study the teaching cases so that they are able to identify problematic areas.

Teaching cases are defined as "...description of students' difficulties in understanding Geography concepts considered appropriate to their grade level, as they attempt to make sense of the natural world, followed by teachers attempts to guide students



towards conceptual based understanding of Geographic concepts” (ibid: 118). Once concepts have been organized, a number of questions and answers relating to learner achievement and performance are identified. In addition, the methods used by teachers in developing Geography numeracy skills are reviewed.

Good and Brophy ( 1995 : 17 ) emphasize the role of teachers in the development of skills in that they “... not only have to explain concepts and demonstrate skills, but they also have to monitor students for apparent understanding and provide feedback to students’ responses”. All this must take place within a classroom context where teachers have to maintain pupil attention, respond to interruptions and progress through activities of the learning process.

## 2.2 THE SIGNIFICANCE OF THE RESEARCH.

The researcher, as a Standard 10 Geography teacher, felt challenged by the failure rate of learners in the application of numeracy skills. As a sequel to the exposition of the weaknesses and difficulties experienced by the Standard 10 learners in the Examiners’ Report (Department of Education and Culture :1991-1995), the issue was felt to be worth investigating. It was the view of the researcher that the way of teaching Geography numeracy skills is an important factor responsible for the learners’ high failure rate. Hopefully, the investigation might begin to answer some of the questions that teachers have, and equip them with more strategies of teaching for the benefit of learners.

## 2.3 THE NATURE AND SCOPE OF THE INVESTIGATION.

### 2.3.1 The nature of Geography numeracy skills.

Apart from the envisaged geographical knowledge, learners must master a number of skills. These skills include map reading, identification of geographical phenomena, simple measuring and elementary interpretation of quantitative data (Holmes & Moorhouse 1991).

Firstly, the skills involve observation of spatial geographical phenomena. In order to arrive at a correct and accurate observation, the learners must use observation aids such as aerial photographs, topographical maps and measuring instruments. Secondly, numerical skills involve the ability to manipulate qualitative and quantitative data for analysis and interpretation of geographical phenomena.

The current Geography learning programme for Standard at 10 Higher Grade states that Geography can make particular contributions to the following skills:

- Oracy and literacy : thinking logically, writing concisely, speaking with assurance and accuracy.
- Numeracy: introduce with simple statistical methods, graphs and tables.
- Graphicacy: the ability to draw, name, count measure, calculate, estimate, read, describe and interpret.
- Interpretation: of pictures, photographs, statistics and maps.
- Fieldwork techniques: using either the traditional and scientific approach.

### 2.3.2 The Geography Learning Programme for Standard 10 (Grade 12).

The numeracy skills are required from map reading and interpretation and aerial photograph analysis and interpretation.

#### (a) Map reading interpretation

This section includes skills acquired from calculations which include the following -:

- (i) Scale interpretation and conversion.
- (ii) Map orientation: true and magnetic bearing.
- (iii) Magnetic declination: angle between true and magnetic North.
- (iv) Grid reference: location of a place on the map.
- (v) Gradient: determination of steepness of slope.
- (vi) Horizontal and vertical distance.
- (vii) Determination of a vertical interval.
- (viii) Determination of an area of a map.
- (ix) Vertical exaggeration.
- (x) Intervisibility.
- (xi) Distances on a map.
- (xii) Problems involving time distance and speed.

#### (b) Aerial photograph analysis and interpretation.

This section includes the following skills:

- (i) Scale determination and interpretation.
- (ii) Distances on a photograph.

(iii) Scale conversion.

(iv) Unit conversions e.g from kilometres to metres (ibid: 1995).

(Swanevelder, Huysteen and Kotze 1987).

## 2.4 CONCLUSION.

To sum up, the differences of numeracy skills as depicted in the topics of the learning programme, demonstrate that Geography teaching demands the use of a variety of methods. In order to accommodate individual differences, the importance attached to different skills should be related to the abilities and the maturity of learners. Knowledge gained from teaching should be integrated with the skills learned. The researcher expects that by using Perkins' Theory One (1992) and the Tharp and Gallimore's (1988) neo-Vygotskian means of assisting performance, learners will be competent in the use of Geography numeracy skills and the quality of teaching will be improved.

### **CHAPTER 3: LITERATURE REVIEW.**

#### **3.1 INTRODUCTION.**

The problem of poor performance and low achievement in Geography calculations has raised concerns, not only from tertiary institutions in which students after Standard 10 are admitted, but also from the Geography teaching community at large. Good teaching eventuates in the retention and ability to use of knowledge and skills. Cullingford (1995:10) views the characteristics of the effective teacher as :

- **Integrity**-the quality of someone who is doing his best, modestly and without self consciousness.
- **Learning**-The quality of enjoying learning and sharing a sense of curiosity.
- **Organisation**-The quality of managing a classroom, with good preparation, clear rules and expectations, attention to detail, the best use of classroom facilities, as well as knowing when to teach the class as a whole, in groups, or individually.
- **Communication**-The quality of showing interest in other people, both pupils and colleagues, and being able to demonstrate that interest through ideas and stories, as well as through shared values.
- **Humour**-The quality of showing a sense of humour as a sign of being an approachable personality to whom children can relate. All these qualities are central to effective teaching.

The problems that militate against the intensification of the teacher's work and the

implementation of teaching strategies call for a redefinition of good teaching. Woods (1996:23) describes the notion of a good teacher : “Good teachers need to have a mastery of the subject knowledge they teach and the professional skills needed to teach it to children of different ages, abilities, aptitudes and backgrounds.” In the continuous quest to increase educational standards, teachers have to step up the efforts and quality of teaching. Woods (1996:31) further describes the criteria, according to which ...the quality of teaching can be judged :

- teachers have clear objectives for their lessons;
- pupils are aware of these objectives;
- teachers have a secure command of the subject;
- lessons have a suitable content;
- activities are well chosen to promote the learning of that content;
- activities are presented in many ways that will engage and mitigate and challenge all pupils, enabling them to make progress at a suitable pace.

Good teaching, therefore, goes hand in hand with the maintainance of educational standards. The methods used by teachers in the classroom should be consistently checked in order to maintain a balance between good teaching and accepted standards of education.

### 3.2. CONSTRUCTION OF KNOWLEDGE.

Teaching involves enabling the learner to construct knowledge. For this exercise to be successful, educational theorists propose some guidelines for effective teaching. Apart from the difficulties that emanate from factors outside the learner, there are problems within the learner that militate against the acquisition of knowledge. Even the methods of teaching may

be used in such a way that do not help the learner. Some of these problems are discussed hereunder.

### 3.2 .1 The problem of fragile knowledge.

Teaching involves facilitating the acquisition of knowledge and skills by the learners. This process begins, in the teaching-learning situation, with the information that is presented in lessons as facts, concepts, principles, rules and ideas. It is in the learners' cognitive processing of the information that it is transformed into knowledge -a constructivist outcome of learning. The opposite of "generative knowledge" seems to be what Perkins (1992:21) terms "fragile knowledge" whereby learners fail to remember, understand and use actively what they have been taught. "Generative knowledge that does not just sit there but functions richly in people's lives to help them understand and deal with the world." (Perkins 1992:05).

The domain in which Geography numeracy skills fall, in terms of Piaget's cognitive developmental model, is logical-mathematical knowledge which is abstract and invented from actions on objects of which actions are the source. (Piaget 1978:47). According to Piaget, mathematical activity involves the reflection and co-ordination of current actions so that they are reorganized in a logical way. This also involves the solution of problems involving numerical and spatial relationship by means of concrete and formal operational thinking. "He (Piaget) rejects the traditional view that learning is a matter of acquiring static knowledge about a "real" world that existed prior to and independent of the learner". Piaget (1981:60) further analyses affective and cognitive functioning and maintains that mathematical operations

will not be changed either by one's feelings of success or failure, functioning of diligence, logic and perception. He further ascribes the differences in the performance and learning of mathematical operations to the following explanations:-

- A child may take mistakes because of affective interference ; but even so, he will not invent new rules of addition.
- If the child is encouraged, the results may be better; if not, there may be regression to the level of pre-occupational thought. In either cases no new structure will be seen.
- Different subjects will not perceive the same elements of a complex figure, their choices being inspired by different interests; nor will children and adults perceive the same details. (ibid).

Bruner (1966) sees learning as involving three almost simultaneous processes, namely

- acquiring of new information
- transforming of knowledge, and
- checking the pertinence and adequacy of knowledge.

Bruner's (ibid) notion of these processes is suggestive of knowledge as being active and usable. In the school situation, selection and retention of knowledge is ultimately intended to be put in proper use at a later stage. This would apply in the case of the geographical knowledge, as with any other kind of knowledge.

The nature of Geography numeracy skills involves different types of knowledge which can be differentiated as :



(i) **Declarative knowledge**-This is what is normally described as “knowing that”.

(Gagne 1985:48). In Gagne’s taxonomy of learning outcomes, it is categorized as verbal information which individuals have learned when they are able to talk or write about it. “It refers to the vast bodies of organized knowledge that learners acquire through formal schooling, books, television and many other means.” (ibid:48). Declarative knowledge in Geography encompasses the knowledge of spatial distribution of geographical phenomena as observed from maps and photographs. In this area, learners appear not to have a clear idea of concepts, cannot identify certain phenomena represented by conventional signs and are to remember the formulae used in calculation of exercises. Perkins (1992:21) calls this problem “missing knowledge”, which describes a period during which learners do not know bits of information they are supposed to know. The failure to remember the facts and skills when required to do so is attributed to the kind of teaching which requires learners to memorize without understanding. That is why Perkins advocates the “schooling of minds” instead of the “training of memories” so as “...to expect students to emerge from their education with a fund of basic knowledge that orients them to the world around them and equips them to its unfolding events and ideas.” (ibid).

(ii) **Procedural knowledge**-This is commonly known as “knowing how to, and knowing how not to.” (Gagne 1985:48). This type of knowledge involves the intellectual skills that determine knowing how to apply a particular skill and therefore being able to demonstrate it. In Geography numeracy skills it is related to the ability to manipulate quantitative data i.e. the ability to draw, count, measure and estimate. The Standard 10 Geography examiners report that

many students are unable to :-

- calculate the time in relation to map distance travelled .
- calculate distance, true bearing, magnetic bearing, magnetic declination and area of a map.
- apply concepts covered in the theoretical section on topographical maps.
- apply numeracy skills to the real landscape.
- Interpreting grid references.

(Department of Education and Culture 1991-1995).

Learners who do remember but do not know how to apply meaningfully information that has been taught are said to have acquired “inert knowledge”. This knowledge does not come to mind in situations where application thereof is needed. Perkins (1992:22) contends that “conventional instruction- reading textbooks and listening to lectures- tends to produce inert knowledge.” John Bransford et al (Perkins 1992:22) found in their experiment on informative usage that “the students who had studied the information in the conventional way made hardly use of it. But the students who had studied the same information in the problem-solving context ... made rich and extensive use of the information.”

Learners who are able to retain and remember knowledge but cannot use it in thinking for problem-solving, such as in the case of Geography calculations, have inert knowledge even though they know the formulae, because that knowledge is not put to work. Driscoll (1994:162) suggests the use of “authentic, situated instructional activities” in which learners

participate in meaningful and purposeful activities within which knowledge and skills are used.

For example, school children learn to estimate in a meaningful way when they do so in a context of some activity within which estimation has a purposeful function.

(iii) **Conditional knowledge**-This is metacognitive knowledge that enables the learners to determine when and when not to; how and how not to apply declarative or procedural knowledge. For example, in order to know the altitude of a hill on a map, one must analyse the contour lines from the lowest to the highest. In the Geography numeracy skills, conditional knowledge can be equated with the analysis and interpretation of quantitative data on maps and photographs. The Standard 10 learners reveal weaknesses in integrating mapwork and theory.

Most learners also reflect a serious deficiency in their grasp of certain basic but very crucial concepts. They learn the subject without being able to interpret the map and photograph features into reality. This deficiency in interpretation is related to Perkins' (1992:25) "ritual knowledge". This is knowledge which is learned through associations and routines of problem-solving. Such knowledge is learned but not understood. It cannot be explained or expressed.

The fourth and last problem of knowledge is "naive knowledge" which is clouded by preconceived ideas which are regarded as legitimate even after correct teaching about the issue in question has been given. Perkins (1992:23) further explains that "...many youngsters, even after receiving some instruction with globes, still believe that the world is flat!" When the problems of missing, inert, naive and ritual knowledge combine in a learner they display a

cluster of symptoms and behaviours which Perkins (ibid) terms the “fragile knowledge syndrome”. Since declarative knowledge is, by definition, inert, on its own it fails as an important goal for learning. What is important is the acquisition of the uses of knowledge in different situations and contexts. Whether knowledge is acquired from school subjects such as Geography, it is transferred to new instances, problems and other everyday performers. In Perkin’s Theory One (1992:43), he indicates that the lack of the minimum conditions for effective learning can contribute to the lack of learning. (ibid:45). The success of Geography numeracy skills taught during lessons will be manifested in their application in novel contexts and new situations such as final examinations. That is why emphasis is placed on the exposure of learners to several application exercises. This refers to the transfer of skills.

In the teaching of skills, Perkins and Salmon (1989:113) argue that transfer of skills occurs in two ways namely :

- (i) Low road transfer- which depends on much practice in a variety of situations leading to a high level of mastery and near-automaticity.
- (ii) High road transfer- which occurs by deliberate, effortful abstraction of a skill from one context and application in another.

Such a transfer can be **forward-reaching** whereby the abstraction of a skill from one context occurs in anticipation for later application in another context. Transfer can also be **backward-reaching** whereby one reverts deliberately to original learning to abstract a skill and apply it as the need arises.

### 3.2.2. Theory one and the transmission view of teaching.

It is evident that Perkins' (1992:05) Theory One centres around the teaching and learning of the content subject matter. This is because of the inclusion of "clear information" as one of the minimum conditions for learning. Such a condition refers to the presentation of knowledge and is therefore content-based. The conditions for learning in this theory do not suggest that information presented in class will ever be purely teacher-centred because through Perkins' "thoughtful practice" (ibid), learners are given an opportunity to participate in active ways in whatever is taught and learned. Through this thoughtful practice, information so acquired is transformed and assimilated by means of processes of cognitive structuring in the learners' minds.

On the other hand, the transmission view of teaching considers the teacher as the dominant transmitter of information to passive and submissive learners. According to this view, clear information means direct transmission of information with very little time given to allow the learners to practise what has been learned. The current teaching practice is characterized by mere memorization and repetition of the transmitted content. Informative feedback is viewed in terms of verbatim reproduction of memorized material through oral questions and tests. Extrinsic motivation, such as competition among learners is utilized by teachers. Edwards (1996:221) has observed that "pupil's experience of Geography often consists of little more than passive exposure to unrelated chunks of the content held together by convention and habit rather than by any clearly articulated epistemological or pedagogical rationale".

During this teaching process, the learner initiates nothing as he or she is regarded merely as a virtually receptive individual who listens for long periods of time. The well-known metaphors of the “tabula rasa” and the child as a substance to be moulded still support the transmission view of teaching. Perkins (1992:46) maintains that if the conditions for learning are observed to the letter, improved performance in learning is guaranteed. He summarizes the conditions for learning that underlie Theory One as follows:-

For any performance we want to teach, if we supply clear information about the performance by way of examples and descriptions, offer learners time to practise the performance and think about how they are handling it, provide informative feedback, and work from a platform of strong intrinsic and extrinsic motivation, we are likely to have considerable success with learning.

The transmission teacher views knowledge as part of his or her claim to authority and expertise. As the teacher has to provide all knowledge, this demands clear and complete mastery of the subject matter. The learner is not given an opportunity to think. It is the teacher’s business to supply the learner with a standard way of connecting the facts. Barnes’ (1976:151) analysis of the transmission teacher states that “the more a teacher sees knowledge as a valued possession associated with his present status and future aspirations, the less of a part one might expect him to accord to his pupils in shaping the knowledge which is given public recognition in his classrooms”.

The question and answer method that is frequently used is intended to check whether what has been transmitted has been correctly memorized by the learners. During transmission teaching, the activities in which the teacher is involved include speaking, lecturing, instructing and demonstrating while the learner must remain silent, observant, obedient, submissive, passive, attentive and concentrating. After information has been transmitted, learners participate only by writing teacher-prepared notes intended for future references, rather than as a means of learning which involves acquisition and recording of information. When the performance of learners is assessed by means of tests and exercises, the transmission teacher's inclination is towards the kind of writing or responses he or she hopes his or her learners will do. Such responses are in line with his or her own unique expectations, criteria and standards. This assessment, through which the learners' performance is measured, is mainly characterized by awarding of grades and is an attempt to control the learners.

Usually, the transmission teacher continues with lessons which he or she has already planned and does not refer back to the learners' previous work. Learning is viewed in terms of learning a particular subject by means of memorizing of factual information with a view to present it in tests and examinations. Consequently, knowledge that is learned is inert because it has been taught as isolated facts under limited conditions. Even the testing of this knowledge resembles the way it has been taught or learned. Therefore, teachers view themselves as being responsible for handing over ready-made knowledge from the texts to the learners as a ticket for a grade or a certificate. Learners are in this way rewarded through the kinds of knowledge that meet the teacher's approval and standards .

This is the traditional method of teaching which is based on the ancestral philosophy that the old are wise and they display their wisdom by instructing and teaching the young. Such a view of teaching has been severely criticized as it restricts the learner's participation in the knowledge-getting process and it excludes the learner's other experience in and out of school.

### 3.3 AUSUBEL'S MEANINGFUL RECEPTION LEARNING<sub>2</sub>

Perkins (1992:05) stresses the importance of retention of knowledge as one of the goals of education. Ausubel (1969:100) is concerned primarily with how to enable a learner to retain knowledge. He suggests that learners use cognitive structures into which new information is "anchored" and integrated. The integration of new ideas into existing knowledge schemes, is what Ausubel (ibid: 105) terms meaningful reception learning. Ausubel (ibid: 106) further argues that rote learning occurs when learners are presented with a mass of information for which few relationships are provided. What was memorized stands as a piece of information in isolation from the rest of the cognitive structure. That information is not remembered when it is required.

"As a result, both students and teachers are often coerced into treating meaningful materials as if they were rote in character, and students consequently experience unnecessary difficulty and reduced success in both learning and retention." (Ausubel ibid: 105). Furthermore, Ausubel realizes that the teaching of mathematics and science still relies heavily on rote learning of formulas and procedural steps on recognition of stereotyped "type problems", and on mechanical manipulation of symbols. (ibid:106).



Information is retained when it is related to what the learner knows, which is anchored as existing ideas in the cognitive structure. Information then acquires new meaning and learning thereof becomes meaningful. Meaningful learning depends on the nature of the task at hand and the learner's intention and mindset. For example, a poorly presented and written discovery problem may force a student to resort to rote memorization or unthinking application of a formula. Learners may use a rote memorization approach to try to learn logically discovery problems simply because they have an attitude that memorization is the only way to learn. According to Driscoll (1994:115) reception learning occurs when the learner is required to internalize the information in a form that will be available for later use whereas discovery learning occurs when learners first integrate information with the existing cognitive structure and secondly transform the integrated combination in such a way as to discover a means-end relationship.

To help learners adopt a meaningful approach rather than a rote learning set or intention, Ausubel (1969:105) suggests that teachers should use "advance organisers". An advance organizer consists of introductory material, provided in advance of the learning materials, to help learners to relate new ideas to existing knowledge. (ibid:105). Geography numeracy skills can be taught using Ausubel's approach. In order to relate new information with that which exists, concepts and skills learned in the previous classes can be used. Ausubel (1969) further suggests that the organiser should be more general and inclusive because people tend to remember the more general ideas and forget the more detailed specifics. (ibid:105).

In the examination of Ausubel's recommendations for the achievement of meaningful reception learning, Driscoll (1994:126) supplies the following guidelines :

- (i) Instruction should facilitate the linkage between the new information to be learned and that which is already in cognitive structure.
- (ii) Instruction should facilitate discriminability of new ideas in the learning material from both similar and different anchoring ideas in the cognitive structure.
- (iii) Instruction should increase the stability and clarity of anchoring ideas in order to facilitate their availability for later learning and problem-solving.

Central to these ideas is that the acquisition of knowledge, in whatever form, is an active process. Bruner and Ausubel share the idea that a person actively constructs knowledge through relating incoming information to a reference. Therefore, each person should be regarded as an active participant in the knowledge-getting process.

### 3.4 BRUNER'S THEORY OF TEACHING.

With regard to the knowledge-getting process, Bruner (1966:40) examines ways of teaching learners in such a way that they will use the learned information appropriately in a variety of situations and in the solution of problems. For Bruner (ibid:40), a theory of teaching should cover four main aspects constructed as follows :-

First, a theory of instruction should specify the experiences which most effectively implant in

the individual a predisposition toward learning. Such an exploration of alternatives in which learners engage actively and reflectively in the learning material is described by Perkins (1992:45) as “thoughtful practice”.

Second, a theory of instruction must specify ways in which a body of knowledge should be structured so that it can be most readily grasped by the learner. The term “Optimal structure” refers to a set of propositions from which a body of knowledge can be generated...” (Bruner 1966:41). This hierarchical structuring of the subject matter contributes to the grasping and understanding. Perkins (1992:45) maintains that the understanding of information depends on whether it is presented as “clear information” or not.

Third, a theory of instruction should specify the most effective sequences in which to present the materials to be learned. This aspect involves the optimum sequence of the method of teaching, namely one that progresses in forms appropriate to the respective learners’ existing modes of representation such as the enactive, iconic and symbolic order. (Bruner 1966:44). Bruner states that any idea or problem or body of knowledge can be presented in a form simple enough so that any particular learner can understand it in a recognizable. (ibid).

Finally, a theory of instruction should specify the nature and pacing of rewards and punishments in the process of learning and teaching. Bruner and Perkins both recognize the role of motivation in learning although Bruner recommends less of an emphasis on extrinsic rewards and punishments, and an encouragement of what Atkinson (1964:195) refers to it as

“hope for success and fear of failure”.

This means that there must be procedures for stimulating thought in a school setting. Opportunity needs to be given for the learners to use information effectively in problem-solving practices and in mastering skills. Scheffler (1968:20) characterizes teaching as ... “...an activity aimed at the achievement of learning, and practised in such a manner as to respect the students’ intellectual integrity and capacity for independent judgement”. He further outlines the significance of such a characterization by giving two explanations that distinguish teaching from other non-teaching activities.

The first reason that it brings out the intentional nature of teaching is the fact that teaching is a distinctive goal-oriented activity, rather than a distinctively patterned sequence of behavioural steps executed by the teacher (ibid). This is in contrast to Bruner’s (1966) optimal sequences of presentation of materials to be learned. The second way of characterizing teaching is that it differentiates the activity of teaching from other such activities as propaganda, conditioning, suggestion, and indoctrination, which are aimed at modifying the person (ibid).” In the survey of literature it is apparent that both the teachers and learners need constant encouragement and motivation.

Furthermore, different educational theorists continue to investigate reasons for the failure of learners to improve their performance, while the teaching activity of teachers is constantly reviewed in terms of its applicability to new challenges that face the changing education of

learners. However, it is generally accepted that there are no universally applicable criteria for good teaching. Whether feedback is in the form of continuous assessment or in one examination at the end of several years of schooling, or even end of the year or term, parents and "...educators recognize that good instruction requires a constant stream of information about student progress or about possible reasons for their lack of progress." (Nitko 1995:321).

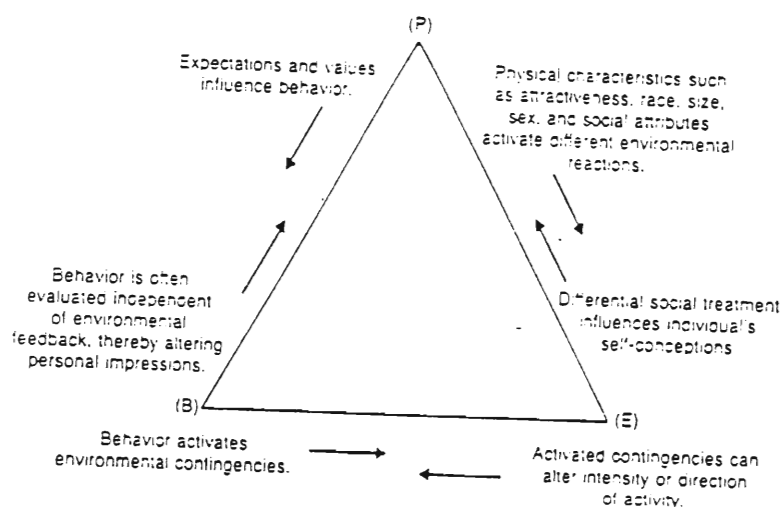
Many learners often feel inadequate and incompetent during their daily encounter with teachers. They do not have a sense of personal success which should motivate them to attain higher performance in tasks requiring problem-solving techniques. Bruner (1966:72) attributes this insufficiency and failure to what he terms "the passivity of knowledge-getting" in which the emphasis is upon gaining and storing information in the form in which it is presented.

The methods generally used by teachers include drill method and repetition which do not lead to the ability to think quantitatively although some learners may respond with 100% accuracy to a given list of Geography calculations. Resnick and Ford (1981:18) state that teaching which stresses concepts and relationships ensures skills and quantitative thinking. Given the proper understanding of mathematical concepts and procedures by using Perkins' (1992) unambiguous descriptions and clear examples, learners would be able to apply their knowledge in novel situations.

### 3.5. BANDURA'S SOCIAL COGNITIVE THEORY.

In his social learning model, Albert Bandura (1986) views the social learning process as consisting of a three way interaction of the environment (E), behaviour (B) and personal factors (P) such as the biological and psychology characteristics of a person. These three factors are highly interdependent as they influence and are also influenced by each of the others. This three-way relationship can be diagrammatically as follows :-

Fig I : THE THREE-WAY RELATIONSHIP OF BEP. (From Bandura 1978)



#### 3.5.1 Reciprocal determinism.

The factors interact via a process that Bandura calls reciprocal determinism because of their power to determine each other and exert an influence on the child. For instance, a learner may observe a teacher's clear presentation of a Geography problem which he or she calculates on

the blackboard as an example. There are several characteristics of the child that will influence whether he or she will imitate this behaviour or not. These may include intellectual skills, attention, expectations, competence, accuracy, memory, motivation, attitudes and other personal factors. Bandura maintains that models mainly influence us by providing information rather than by eliciting matching behaviour which meets the particular needs and values of the observer. (Rosenthal and Bandura 1978:622). Therefore, observational learning can take place without the learner performing the behaviour. This idea is counter to current theory and practice of teaching, in which pupil activity is emphasized in the teaching learning situation. For instance, Zhaohe and Bradbury (1993:245) emphasize that “much less importance is attached to passive learning of the spoonfed factual material than formerly. Much greater emphasis is placed on the provision of students with a basic knowledge of the subject together with practical skills”.

Environmental factors in the school situation might include peers, teachers and significant others with whom the observer or the learner has direct contact. According to Bandura (1986:207), the characteristics of models that facilitate social learning and attract the learners' interest in acquiring their behaviour include :-

#### *3.5.1.1 Peers of similar age and competence*

In the classroom situation, watching others who have successfully completed school tasks enhances the likelihood of observational learning. In a study conducted by Schunk and Hanson (1985), children who had difficulties in subtracting, improved their performance after watching the teacher and the peer models solving problems with success. Another advantage of this

activity is that “ Watching another person solve a problem may provide a better overall idea of the nature of the problem than being immersed in oneself.” (Miller 1993:202).

#### *3.5.1.2 Models that have relevance and credibility*

Models such as teachers might be respected by learners because of their prestige as professionals, their reliability in offering believable standards for learner's aspirations and their trust in them as custodians of knowledge.

#### *3.5.1.3 Models that have high status.*

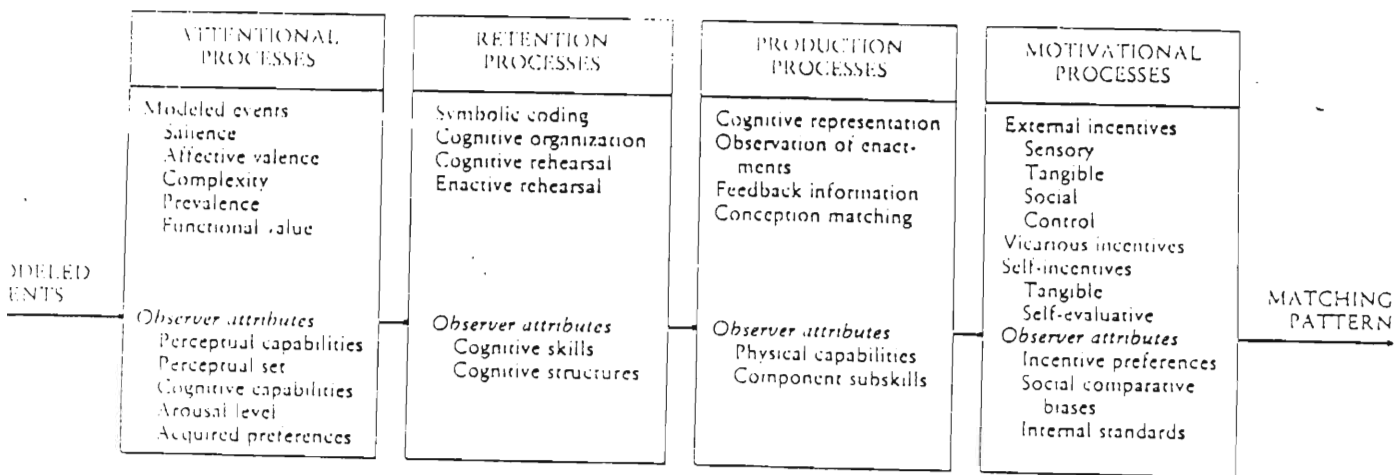
Teachers are also accorded high status by the learners because of their power and authority and they frequently influence the learners in attracting their attention for information. The high status enhances learning. Learners imitate the teachers' behaviour because of their status and power.

### **3.5.2 The learner's cognitive processes.**

The following diagram (Fig.II) illustrates the cognitive processes and other subprocesses that underlie observational learning :-



Fig. II : LEARNERS' COGNITIVE PROCESSES. From Bandura (1986:52) Social Foundations of Thought and Action.



What is consistent with the information processing model in this diagram is the inclusion of attention and retention processes which are important in the acquisition of information. Much like a computer, the child selectively organizes information, processes it, applies rules or principles, weighs it and decides what to do with it .

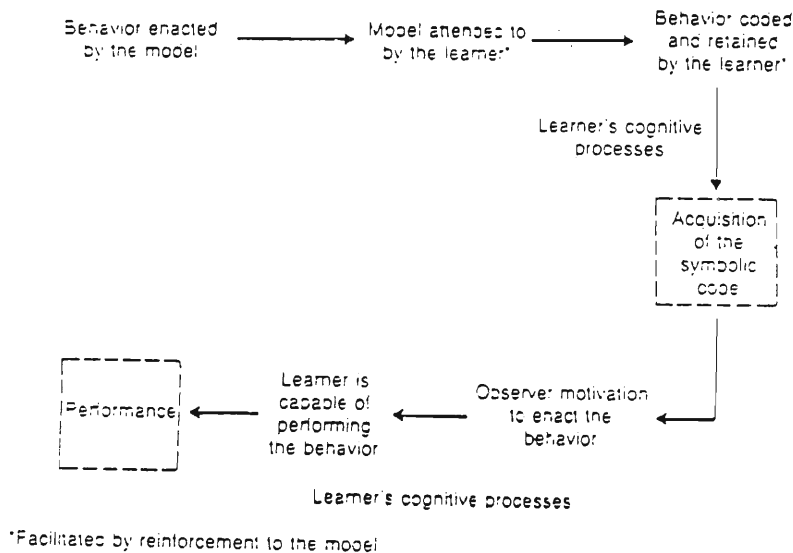
Firstly, attention is likely to be given if the model is salient, and favourably regarded, if the modeled behaviour is simple, if there are plenty of opportunities to see the behaviour and if the model's behaviour has proved to be effective. Children's perceptual abilities, their attention arousal to attend to particular models, their perceptual set (what they expect to see), their cognitive ability and their preferences and interests all influence which characteristic features of the model will be attended. These attributes assist children in choosing appropriate models.

Secondly, the model's behaviour is not only attended to but is retained in the observer's mind for future use when the model is no longer present. The modeled event must be translated into symbolic forms such as visual images and verbal codes which represent the behaviour. The social-cognitive theory, therefore, distinguishes between learning and performance. Performance is viewed as an indicator that learning has taken place while learning is defined as the acquisition symbolic of representations in the form of verbal or visual code, and their function is to serve as guidelines for the future behaviour (Bandura 1986). In order to facilitate the retention of an event, it must be rehearsed. For example, children may frequently imitate actions and demonstrations of the teacher with the view to integrate them in cognitive organization. In this way they visualize themselves as successfully carrying out the desired tasks activities.

Thirdly, when the production stage is reached, children selectively organise encoded responses, which now become representational systems used to compare them with the performed behaviour. Through their own feedback, which comes from their monitoring of performance, children are able to correct and improve their initial performance. Lastly, the three types of the reinforcement, namely direct, vicarious and self-reinforcements, assist in motivating the learner to imitate the model. The learner will imitate the model because doing so will increase his or her chances of being reinforced. Reinforcement affects the learners' motivation to perform the model's behaviour and not learning itself. This means that reinforcement, in whatever form, is the motivator of performance and not the determiner of learning. In short, Gredler (1986) represents the relationships between the behavioural model, the learner's cognitive processes,

learning and performance in sequential diagram (Fig. III) which depicts the steps according to which observational learning occurs.

Fig.III : SEQUENCE OF STEPS IN OBSERVATIONAL LEARNING ACCORDING TO THE SOCIAL- COGNITIVE THEORY. From Gredler 1986:317



### 3.6 VYGOTSKY'S SOCIOHISTORICAL THEORY OF PSYCHOLOGICAL DEVELOPMENT.

#### 3.6.1. Higher Psychological Functions.

Vygotsky's (1978) theory maintains that humans have capabilities that are exclusive to man, and are products of human sociohistorical development and are not purely biological. It is the individual's control, based on culture and social relations that causes transitions from primitive to higher mental functions. In order to map this out, Vygotsky (ibid) further

formulated a theoretical claim about the social origins of individual mental functioning- his general law of genetic development :

Any function in the child's cultural development appears twice, or on two planes. First, it appears on the social plane, and then on the psychological plane. First, it appears between people as an interpsychological category, and then within the child as an intrapsychological category.

This means that the higher psychological functions are part of the social and cultural heritage of a child. According to Vygotsky (ibid), these functions include categorical perception, logical memory, conceptual thinking, abstract thought and self-regulated attention.

These functions differ in a variety of ways from the primitive biological functions that Vygotsky (ibid) describes them as involuntary attention, simple perception and natural memory and are naturally inborn psychological structures which operate from a biological perspective.

The higher psychological functioning according to Vygotsky (ibid) involve the manipulation and development of complex mental functions as the child masters his or her own behaviour through learning the signs and symbols of the culture and by interacting with others in the same culture. This mastery of one's behaviour leads to memory becoming "logicalized" ; that is, it becomes a task of remembering and finding logical relations. (ibid). In the higher mental functions, the relationship between natural memory and thought is the reverse from primitive functioning, in which natural memory dominates thought. "For the young child, to think means

to recall; but for the adolescent, to recall means to think.” (ibid 1978:51).

### 3.6.2. Internalization and Mediation.

According to Vygotsky’s (ibid) theoretical views the process by which the function in the social plane (between persons) becomes part of the individual plane (in the intrapsychological category of the individual) is called internalization. This transfer involves the construction of a mental structure called a plane of consciousness which consists of higher psychological functions that are transmitted by others to the individual in speech, social interaction and collaborative activity. This means that through internalization, the internal mental structures that form the individuals’ consciousness are reorganized and reconstructed by means of social interactions during conversations and speeches of others. For functions to be internalized, all that is needed is assisting interaction of persons. This is because “social relations or relations among people genetically underlie all higher functions and their relationships.” (ibid:163). This is how a child is socialized, acculturated and made human and learns language and signs.

Another process that is important in the theory of Vygotsky is mediation. As he places emphasis on the value of social interaction particularly between the adult and the child, Vygotsky (ibid) describes mediation as referring to the interactional process between the adult and the child in which knowledge and guidance is provided so that the child through his efforts assumes full control of the task performance. According to him, this is how the child learns how to use language and signs as cultural tools of thinking.

Vygotsky (ibid) emphasized the social organization of instruction (teaching) which would provide a special socialization of children's thinking because he regarded schools as cultural laboratories and social settings specifically designed to modify thinking. The role of the teacher in the social contexts of the school is to provide mediation. This mediational process helps internalization to occur. Since assistance through the zone of proximal development (a concept to be clarified below) needs mediation by the adult, the child internalizes higher mental functions necessary for adult and human thought. This means mediation provides scaffolding- a term used by Wood, Bruner and Ross (1976) to describe a support system provided by the teacher to help learners in task performance.

### 3.6.3 Progression in the ZPD.

Consistent with his emphasis on the process of development, Vygotsky (1978) developed a concept he called the zone of proximal development which is:

the distance between the actual developmental level as determined by individual problem-solving and the level of potential development as determined through problem solving under adult guidance or in collaboration with more capable peers. (Vygotsky 1978:86).

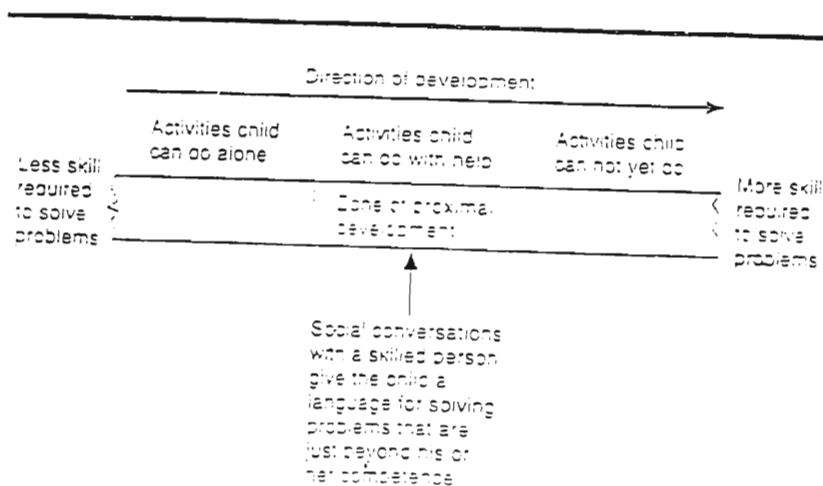
He noted that learning depends not so much on the existing characteristics of the child but on those characteristics that have not yet developed which are in the zone of proximal development.

In his examination of children's skill development, Vygotsky (1978) assigned tasks that went beyond their current capabilities. This is what enabled him to reveal a gap between a child's "actual developmental level" and the "potential development." (ibid). He did this because he believed that "...pedagogy should be orientated not toward yesterday, but toward tomorrow in child development. Only then will it be able to create, in the process of education, those processes of development that are at present in the zone of proximal development."

(1982-84, vol 2:251).

The concept of the zone of proximal development can be represented by means of a diagram which demonstrates the area in which the child can benefit from assistance.

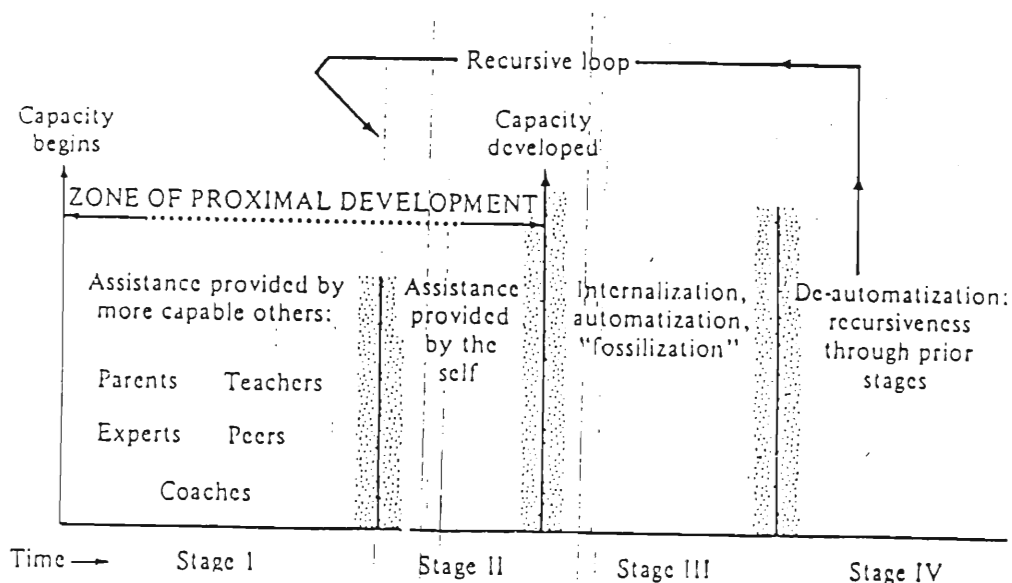
Fig. IV THE CONCEPT OF THE ZONE OF PROXIMAL DEVELOPMENT: From Steuer 1994: 323.



The zone referred to is the gap that exists between what the children are able to do without assistance and what they are able to accomplish when they are interacting with others who are more expert and competent. These include teachers, parents, peers, and significant others. If we conceive of development as proceeding through a certain route from less skilled to more skilled problem-solving, at a certain stage the child is unable to act independently. Beyond that point, the child needs assistance of a skilled adult or peer who can push him or her forward.

An example of this adult assistance occurs when a teacher gives a learner the techniques of solving a particular Geography problems. As the learner becomes able to solve more difficult problems without help, the zone of proximal development is pushed to a more advanced level. The term "proximal" which means nearby, indicates that assistance from the expert will be just slightly beyond or ahead of the child's current abilities. Tharp and Gallimore (1988) further drew a mental construct which shows how progression occurs through the zone of proximal development. This progression occurs in stages which are represented in the form of a diagram.

Fig V: FOUR STAGES OF THE ZPD. From Tharp and Gallimore 1988:35

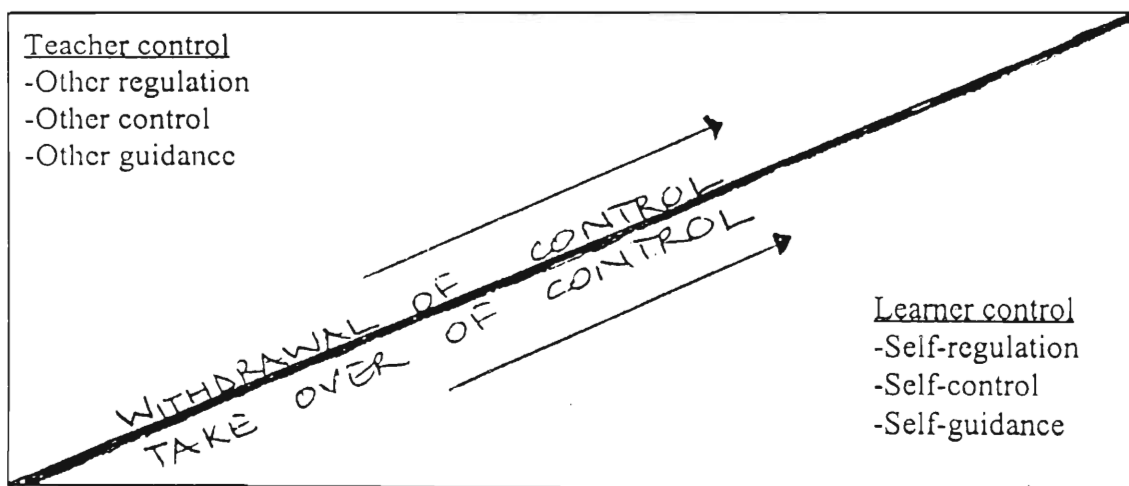




In the first stage, the child is unable to complete certain tasks unaided. The task that a child can complete unaided indicates only the level of development already attained but does not indicate the potential for future development. During this development and learning, assistance is provided by the more capable others. Task performance is almost controlled by the more competent and expert individuals through guidance and modeling given to the learner on how to regulate it.

Through social interaction with others during task performance, the learner begins to understand the nature and the meaning of the task performance while the “capable other” gradually relinquishes control in favour of the learner who is allowed to regulate his own continuing learning, as shown in Fig. VI.

Fig VI : THE SHIFTING OF RESPONSIBILITY. (Adapted from Tharp and Gallimore).



This diagram shows a shift from other-control to self-control. As Tharp and Gallimore (1988:35) note, there is "... a steadily declining plane of adult responsibility." They further suggest that the means such as questioning, feedback and cognitive structuring can be used to assist task performance. (ibid:33). This implies that the learner is not passive in this exercise but is responsive to the other-assistance. The learner does this by giving attention to the helper.

In the second stage, the responsibility of the task performance is taken over completely by the learner. He or she no longer relies on the assistance being given by the capable others when he or she is confronted with problem-solving. "What was guided by the other is now beginning to be guided and directed by the self." (Tharp and Gallimore 1988:37). This self-control and self-guidance does not mean that the learner's capabilities are fully developed. They have reached a stage where the learner is able to direct and guide his or her actions and behaviour towards the fulfilment of the task at hand. Learners can now regulate their own learning without the teacher's assistance and control. This marks a shift from other-control to self-control, from other-guidance to self-guidance, from other-assistance to self-assistance and from other-regulation to self-regulation.

In the third stage, performance of the task is fixed in his or her internal structure. During this stage, the art of performing the task is internalized by the learner and has become his own and the learner can now perform the task fully and automatically and collaboration with a more able person would be disruptive and irritating. "Performance here is no longer developing; it is already developed." (ibid:38). This also signifies a high level of performance.

The fourth stage is characterized by recursion to earlier stages because performance of the task has for one reason or another been de-automatized and has been therefore disturbed.

De-automatization may be due to slight environmental changes, stress, major upheavals and physical trauma. These are changes inside and outside the individual. Consequently, the child is forced to recur or retreat to either other assistance or self-assistance. This may occur even with adults. For example, a teacher-trainee may constantly ask for assistance from other teachers when everything in the class or school situation seems to be new, or may re-think strategies for teaching learnt at college. When the recursion requires assistance from others, that demonstrates an inter dependence between control by self and control by others. The whole exercise is intended to normalize learning through the ZPD until performance is again automatized.

This theory can be applied to the learning of Geography numeracy skills. Such learning is initiated by the teacher who, through his or her guidance, provides the learners with assistance during their social encounter in the classroom. This assistance is not solely the teacher's prerogative and obligation, but learners who have attained a higher level of understanding of the learning tasks also provide assistance through their collaborative activities. Parents too, assist their children, for example, in doing their homework. Those parents who have had schooling in Geography numeracy skills are also subjected to recursion to their earlier learning of such tasks. A progression of learning will occur from other-assistance to self-assistance until the automatic and higher level of performance is achieved. It is in this vein that Tharp and Gallimore (1988) recommend that teaching should target points in the zone of proximal

development where the learner will perform a task when assistance is provided until performance is automatized.

#### 3.6.4 Towards mediational teaching.

Vygotsky's theory rests on the belief that cognitive processes are the product of social and cultural interaction. While Piaget was concerned with how cognitive development takes place from "inside out" Vygotsky was more concerned with how it happens from "outside in." (Moll 1990). Although both Vygotsky and Piaget emphasized the internalization of interaction between a child and the environment, Piaget (1978) stressed motor action on physical objects while Vygotsky (1978) was more interested in social interaction. (Miller 1993:386).

According to Vygotsky (1978), the structure of conversations becomes the structure of thought. Further, humans master their behaviours by means of interactions which come from outside through psychological tools. Cultural and psychological signs or tools include language systems, counting systems, writing, diagrams, maps, conventional signs and works of art. (Miller 1993:388). Included in these are "material tools" that mediate between people and the natural world. So material tools are things that people produce to help them accomplish some tasks. (McCown, Driscoll and Geiger 1996:42). Maps are produced by people to represent the real landscape and its features. In their interaction, teachers guide their children in appropriate ways and thereby develop their capacity to use material tools such as calculators and

instrument boxes and psychological tools such as mathematical symbols, conventional signs and language.

Psychological tools mediate between individuals in their social interaction and are socially negotiated between them. For example, when a child puts up a hand, he or she signals to the teacher that he or she wishes to speak. Miller (1993:391) maintains that “tools help shape children’s thinking and children use tools to express their thoughts to others.” Children progressively develop knowledge in collaborative activity with mediating more knowledgeable others such as parents, peers, teachers and others in social context who intentionally intervene in the learners’ cognitive development. The psychological tools, i.e. the mediational means, serve to transform primitive mental functions into higher psychological functions which enable individuals to solve problems at a higher level and think abstractly. The mediation process therefore is conceptualized in Vygotskian terms as social interactions and the social relationships between the capable others and the child in which knowledge and guidance is provided.

Mediation occurs in the zone of proximal development, a “critical space” where a child cannot understand something on her own but has a potential to do so through interaction with another person. (Donald, Lazarus and Lolwana 1997: 50). That is why mediational teaching should target that critical gap of potential development so that the child’s understanding is shifted to a new level. It is abundantly clear that if a teacher presents concepts and facts that are far beyond the learners’ comprehension, they will be lost. Again, if the teacher presents well-

known information, children will lose interest and not attend. But if teaching is directed to where the child can understand with assistance, that signifies mediational teaching.

This process has to involve an intentional effort to help learners organize and understand information. Learning is most effective when it occurs in the zone of proximal development where there are those functions that have not yet matured but are in the process of maturation, functions that will mature tomorrow but are currently in an embryonic state. (Tharp and Gallimore 1988: 30).

This view is in contrast to Piaget's cognitive development which advocates that learning can occur only after certain capabilities have been developed. (Gredler 1992:295).

The development of higher psychological functions is indispensable as it leads first to the mastery of language, counting and writing and secondly to learning to use signs and symbols of culture to regulate one's thinking. (Vygotsky 1978). In this way, ideas, knowledge and skills are mastered through social interaction between the teacher and the learner.

In the school context, what is mediated is the broader social constructions of meanings such as ways of understanding and interaction, values, information and knowledge which are divided into subject or field of study. During mediated learning, the child internalises new meanings and adapts them to fit what is widely understood and accepted by other people. During these social interactions, the child is not passive but is actively involved, for instance by way of answering and asking questions, giving suggestions or defending his or her position

until the new meanings are understood. Furthermore, there is “intersubjectivity” between the teacher and the learner. (Wertsch 1985: 161). This intersubjectivity occurs when both the teacher and the learner negotiate a mutual understanding of the task at hand, and of the techniques of bringing a solution. Intersubjectivity therefore implies interdependence, whereby both depend on each other in the solution of problems and accomplishment of tasks. Therefore, the teacher does not dominate the social interaction or simply demonstrate a solution to a problem. Instead, he or she adjusts the problem to the level of the student.

Perkins’ (1992) minimum conditions for learning can be pursued using mediational teaching. When “clear information” is presented by the teacher, he or she adjusts the presentation by using descriptions and examples to suit the level of comprehension of the learner. This demands a higher level of competency on the part of the teacher in the subject he or she is teaching. In order to communicate knowledge and information, the teacher must have mastery of that knowledge. Vygotsky (1978) emphasises the role of interaction between the teacher and the learner in the transmission of knowledge. In his view the learner benefits when he or she is helped by another who knows the task at hand. The teacher may also benefit in the social interaction since the processes of information-giving renders him or her more clear and more objective in the understanding of the task.

In the “thoughtful practice” of Perkins (1992:45), learners are actively involved in the social interaction. This means learners are not just passive listeners during the presentation of the lesson. They participate together with the teacher in solving problems, for instance, through

written work or oral responses. In their reflection on their own learning, they understand how they progress. The “ informative -feedback ” is given by means of guidance which the teacher gives during the social interaction with the learners. The fact that learners are placed on an equal footing with the teacher in their intersubjective relationship, provides a “ strong intrinsic motivation” to participate in mediational learning.

It is through this mediation that there is support for learning from the teacher. Since mediated learning is assisted learning, it is related to the idea of scaffolding which originates from Vygotsky’s theory. By means of scaffolding, the teacher provides a child with a great deal of support during the early stages of learning, to help him or her progress from the current abilities until he or she takes over responsibility of task performance. (Wood et al 1976).

In assisted or mediational learning, the teacher, is responsible for teaching the learners the psychological and cultural tools until these are internalised in their minds. Higher mental functioning will occur as a result of the mastery and internalization of skills that are taught. The ability to internalise the skills depends on the learner’s age and cognitive development. According to Vygotsky (1978), during the process of assisted learning, there are mediated behaviours which include the child’s symbolic thinking and higher mental functions and the teacher’s ability to direct memory and attention of the learner. When the internal mediators have been acquired, they permit the occurrence of greater self-mediated learning.



### 3.7 THEORY ONE AND ASSISTED PERFORMANCE.

#### 3.7.1 Introduction of the theoretical frameworks.

The rationale behind the linking of principles of teaching advocated by Perkins (1992) in his model of Theory One and Beyond and the theory of teaching devised by Tharp and Gallimore (1988) is an attempt to formulate a set of guides that aim at maximizing the activity of teaching and learning in the classroom situation. Perkins (1992:43) introduces what he calls “Theory One and Beyond”, as an attempt to solve the problem of fragile knowledge in learners which has been acquired through the rote learning of the so-called “recitation script.” (Gallimore and Tharp, 1991:188).

Perkin’s Theory One is based on the principle that : “People learn much of what they have a reasonable opportunity and motivation to learn.” (Perkins 1992:45). Tharp and Gallimore (1988) integrated a neo-Vygotskian theory of development with various theoretical considerations central to the behaviouristic and cognitive models of learning. They regard teaching as “assisting performance in the zone of proximal development. (ibid). Since this theory of teaching is based on the Vygotskian perspective, teaching is defined in terms of created classroom activity settings in which learners are developed intellectually so that they progress in their ZPDs. According to this model, the activity settings are organized classroom social contexts and productive goal-oriented interactions between the teacher and the learners. The social contexts and the interactions aim at the maximum performance of the learners in the zone of proximal development through the assistance given by the teacher.

Tharp and Gallimore (1988) propose a list of six means of assisting performance in zone of proximal development. On the other hand, Perkins (1992) advocates four minimum conditions (which have been referred to before) which can guarantee learning and the creation of a better classroom practice. In both cases, there is no set order or sequence, because they depict, by their different nature and quality, different settings and the contexts. The means of assisting performance such as modeling, instructing, cognitive structuring, informative feedback, questioning, and contingency management have been adapted from different approaches to learning, where they appear to be dominant, with a view to build an integrated theory of teaching. Gallimore and Tharp (1991:175) maintain that “the most effective teaching occur in other settings of socialization, from child-rearing to employee-training programmes. It is from these teaching-learning but cultural interactions in non-schooled settings that principles can be derived for the production of effective teaching”.

In the teaching of Geography numeracy skills both the means of assisting Tharp and Gallimore (1988) and Perkins' (1992) conditions for learning can be used to replace the traditional chalk-and-talk method which has dominated lesson-presentation for a long time. It is desirable that the methods used in the teaching of these skills include Gallimore and Tharp's (1991) means of assisting performance in the zone of proximal development as this is viewed as a remedy to solve the problem of fragile knowledge. However, while not negating the significance of the presentation of links between Perkins' model and that of Tharp and Gallimore (1988) it is important to note that, for the purpose of this research, more emphasis will be placed on Perkins' minimum conditions (1992). Tharp and Gallimore's (1988) means of assisting

performance will be used as a sub-component of Perkins' model. The interdependence of the means of assisting performance and Perkins (1992) minimum conditions for learning are discussed hereunder :

### 3.7.2 Perkins' clear information.

#### 3.7.2.1 *Modeling : Tharp and Gallimore*

Firstly, according to Perkins (1992:05), information should be presented in clear and unambiguous descriptions. It should be given in an active and usable form of examples for the goals of learning to be realized. Secondly, the knowledge needed by the learners should signify "generative knowledge" which should be retained, understood and put to active use. If knowledge is not missing, it is remembered and is put to work when the need arises, and so good performances can be expected. This is possible when the teacher's verbalizations of information are clearly presented while he or she demonstrates thorough knowledge of what he or she is teaching.

This condition seems to be parallel to modeling, Tharp and Gallimore's (1988) first means of assisting performance. This is a behavioural learning principle which is developed in Bandura's social cognitive model (1986). Modeling occurs when learners imitate the model's behaviour after the consequences of such a behaviour have been observed and watched. In its obvious form, modeling is learning by example. If the example is a desirable one, then desirable behaviour will be a likely outcome and vice versa. The demonstration of behaviour may take the form of acting out the behaviour concerned and may be accompanied by verbal remarks or

the model may use only verbal remarks or the model may use only verbal descriptions of the required behaviour.

Gallimore and Tharp (1991:178) view modeling as the process of offering behaviour for imitation. Behaviour is imitated in various forms such as language learning and the enculturation of children and new members through the influence of the mature members. Modeling may occur in the family context, for instance, boys imitate the behaviour of their fathers when they do garden work and the girls imitate the behaviour of their mothers when they cook and clean the house. Modeling will occur until the performance of these activities is automatized and does not need consciousness. Children take part in these activities through what Rogoff (1990) calls “guided participation” -a process in which the child takes an active role as he or she is guided and interacts with skilled members of a culture (Steuer 1994:324). Imitation of these modeled activities can be strengthened or weakened by reinforcement and punishment.

During the process of modeling, children form mental images of what is required of them in the different situations and are later able to use those mental images to guide their behaviour. (Tharp and Gallimore 1988:48). The coding of modeled activities into the children’s minds increases learning and retention of skills which are needed for competent performance. Through watching others, a person forms an idea of the behaviour to be modeled and visualises how this behaviour can be practised in various settings. In addition to trainers of teachers in the educational setting, “...peer models are highly important sources of assisted

performance, for children and adults alike.” (Tharp and Gallimore 1988:49).

Modeling is a powerful means of assisting performance in the teaching of skills. For students to learn and perform the skills they must observe a demonstration and expert performance of those skills in a task context. In the teaching of Geography numeracy skills, modeling can occur when a teacher demonstrates how to solve problems. In this way, the teacher demonstrates cognitive strategies for modeling by learners. Rogoff (1990), directs how learning through modeling should occur: “Stay near the trusted guide, watch the guide’s activities and get involved in the activities when possible, and attend to any instruction the guide provides”.

Bandura (1987:159) emphasizes that “...modeling influences have much broader psychological effect than the simple response mimicry implied by the term imitation”. Central to this idea is that modelling influences have two major functions, namely:

1. To assist in the acquisition of new patterns of behaviour which have not yet been learned but are reproduced later in an identical form.
2. To strengthen or weaken inhibition of previously learned behaviours by means of the observation of rewarding or punishing consequences. (ibid).

In Geography map studies, the model may be presented to the learner in the form of pictures, maps and aerial photographs. Also learners may imitate the clearly presented information in the form of the teacher’s calculation of examples. These then become a springboard for the learners’ independent computation. Modeling, therefore, needs a thorough knowledge of the

subject matter by the teacher so that the learners emulate exemplary behaviours, attitudes and actions. Perkins' (1992) idea of clear information is significant regarding modeling. The presentation of clear information by the teacher helps the teacher's demonstration to be internalized by the learners. The acquisition of clear information by learners is likely to lead to good performance.

### *3.7.2.2 Instructing :Tharp and Gallimore*

In terms of Perkins (1992) "clear information" construct, when information is presented in an active and usable form, this implies telling or instructing learners to acquire the given facts and demands compliance with the requirements of the learning material. The teacher expects the learner, after the teaching and learning of "clear information", to shift from the position of being a seeker of knowledge to being the user of knowledge and thus control is transferred from the adult to the child.

When instructing is used for behaviour management in class, it is intended to level the ground for the knowledge- constructing process to progress unhindered. Standards of performance expected of learners are set by the teacher not only through modeling and instructing, but also through the teacher's effective handling a lesson as he or she demonstrates clarity of purpose. In addition, when information is presented to the learners, the voice of the teacher should be clear. "When giving instructions, it is important to first ensure that all learners are attentive and ready to share the information with the teacher. No one should be writing, shuffling papers, working on something or otherwise distracted." (Walkin 1991:83). This means that instructing

as a means of assisting performance is interdependent with Perkins' (1992) "clear information" construct.

This means of assistance involves telling children to do this or that and calls for compliance. Instructing is linked to contingency management and feeding back. Feeding back is part of normal life as people are forever telling one another what to do. Giving of instruction requires careful preparation if those instructions are to be understood and followed. The understanding of instructions, in the form of words, will be insufficient to teach anyone a skill. The accomplishment and development of a skill will require practice. This may begin by mimicking a demonstration by the teacher and later followed by guided discussion and practice.

In educational settings, instructions are used in two contexts. Firstly, instructions are used for behaviour modification in order to improve self-control. For instance, children are instructed, "stand up" as a sign of respect to authority. Secondly, instructions are used when directing the students to do certain tasks, for example, "Open your books," "Clean the blackboard," "Get a piece of chalk". Instructions occur when the teacher assumes responsibility for assisting performance. It is not expected that the students can just learn on their own without instruction because through this means, they are given the direction of how to go about in their tasks.

Instructing is linked with other means of assistance. In the same way as modeling provides standards, these can also be set by simple instructions. Feeding back on performance can be demonstrated by means of giving instructions and using contingency management in praises

and encouragement. When instructing is used during the teaching process, the internalized voice of the teacher becomes self-instructing to the learner. It becomes a small quiet instructor within the learner. The responsibility and the control shifts from the teacher to the learner in order to develop a “self-regulated performer” (Gallimore and Tharp 1991:181). In this way, learners are assisted in their ZPDs. But if instructing is used excessively, it will be a hindrance to the children’s progress through the ZPD. That is why Gallimore and Tharp (1991:181) give a warning that too much instructing would be obnoxious to the learner. Instructions, therefore should be used with and within limits.

### 3.7.3. Perkins’ thoughtful practice.

#### 3.7.3.1. *Cognitive Structuring : Tharp and Gallimore.*

Bruner (1966:41) advocates that students should learn the structure of a field of study so as to facilitate the manipulation and transformation of new knowledge and the refinement of previous knowledge in the cognitive structure. He further suggests that when students are helped to grasp the structure of the field of study, they are more likely to remember what they learn, comprehend principles that can be applied in a variety of situations, and be prepared for mastering more complex knowledge. (1966:48).

Cognitive structuring refers to the provision of a structure for understanding, learning, thinking and action. The structure organises perception for the learner so that information which is incoming is encoded in the previously learned knowledge. In the teaching process, teachers



may use the cognitive structure for the explanation of different concepts and ideas. Learners can use the structure for grouping and sequencing of information in order to facilitate recall.

Perkins (1992:05) maintains that by means of thoughtful practice, opportunity is given to learners to take part in problem solving situations. “Thoughtful” implies that learners are given exercises to think with the knowledge thus learned and to practise using it in a variety of situations. Learners also have to reflect on their own learning metacognitively in order to learn how they learn.

The fact that learners, in terms of Perkins’ (1992) model are given thoughtful practice implies that they are engaged in cognitive exercises which require the utilization of their own cognitive structures. This activity embodies manipulation of learned knowledge and an application thereof in a variety of situations. Ideas of this knowledge can simply be represented as diagrams, maps, photographs or formulae to assist cognitive structuring. Teachers have a role to play by way of giving exercises that enhance this “thoughtful practice”. In this way, learners are able to apply their knowledge in a wide range of problems.

According to Tharp and Gallimore (1988), there are two kinds of cognitive structures. Type I includes a structure for explanation. A teacher may explain how to calculate a magnetic declination over a certain number of years for a given map. In this case, the learner learns how to sequence the steps involved in the solution of this problem. In Type II cognitive structures, learners may be assisted by the provision of structures for memorizing the content or rules on

how to organise evidence for explaining or substantiating a particular idea. Examples of this type are drawing of mind-maps, mnemonics, headings, and key words. Meaningful learning will occur when new information is integrated into the learner's existing cognitive framework. Successful teaching should have memory- enhancing strategies that transform and organise information to make it more retrievable. In this way, learners are helped to analyze their own acts of perceiving, storing and recalling so that they gain greater conscious control over each stage of the memory. In short, this type of cognitive structure is concerned with information-processing.

Cognitive structuring can assist performance by means of a mutual participation of the learner and the teacher. This means of assisting is related to Piaget's (1978) schemes which are organized patterns of behaviour and action, and Ausubel's (1969) anchoring of ideas in a scheme. Because the provision of cognitive structuring accelerates learning, it assists performance in the learner's ZPD. Biehler and Snowman (1993:447) emphasise that "...an important aspect of the problem-solving process is the ability to activate relevant schemes from long-term memory when they are needed. The more relevant and powerful the activated scheme, the more likely an effective problem solution will be achieved".

### *3.7.3.2. Ausubel's hierarchical structuring.*

Ausubel (1969) views learners as having a cognitive structure which is dynamic and susceptible to changes. His meaningful reception learning is based on scheme theory, which maintains that information is stored in networks of connected facts and concepts that provide

a structure for making sense of new information. He says that cognitive structure is “...hierarchically organized in terms of highly inclusive concepts under which are subsumed less inclusive sub-concepts and information data.” (Ausubel 1969:99).

This means that Ausubel (1969) views knowledge as organized into hierarchical structures in which subordinate concepts are subsumed under higher-level super-ordinate concepts. Meaningful learning will occur as a result of the assimilation of new material into the existing hierarchical cognitive structure and anchoring it into the main elements of this structure. This assimilation process is thought to be compatible with the fact that information that fits into the existing cognitive structure is more understood, learned and retained than information that does not fit but is memorized as in rote learning.

Ausubel (1969:100) recommends expository teaching in which the teacher presents main themes or ideas before presenting details. He calls this preparatory material an “advanced organizer”. Advance organisers provide superordinate concepts and put the new information in meaningful context. According to him knowledge should be structured around key concepts with specific information grouped under general categories. This is because key ideas associated with a particular cognitive structure are easily retained. Such a structure provides a scaffolding for the learner to retain information in an organized form. It is a framework for organizing detailed information and relate or interpret it in terms of the existing knowledge.

In the expository teaching of Geography numeracy skills, the teacher can provide learners with simplified models or sketches that depict local places or information already in learners' minds. This will provide a step-by-step progression from the general concepts to new information and the ultimate assimilation of new knowledge in the learners' cognitive structures.

Ausubel's (1969) hierarchical structuring models shared by Resnick (1983:89) in his view of a learner and learning. The following are the characteristics of learners according to Resnick (ibid) :-

- (i) In their construction of understanding, learners look for meaning and will try to find regularity and order in the events of the world.
- (ii) Learners are able to know and understand relationships of things because human knowledge is stored in clusters and organized into schemes that people use to interpret familiar situations and to reason about new ones.
- (iii) Since all learning depends on prior knowledge, learners try to link new information to what they already know in order to interpret new material in terms of established schemes.

### 3.7.4. Perkins' informative feedback ✓

#### 3.7.4.1. *Feeding Back : Tharp and Gallimore.*

According to Perkins (1992:45), providing informative feedback involves monitoring the performance and progress of learners by means of various methods of assessment and

providing objective assistance by way of finding out the problems experienced by learners through counselling and guidance, so that they proceed in their learning vigorously and effectively. Feedback may be obtained during a review of performance, where learners are able to find out how well they have done. They are able to compare and verify with the teacher their outcomes against the required performance.

Feedback is provided after the observation of the effects of learner's performance. Gagne (1985:75) claims that feedback is "...the event that provides the learner with the confirmation or verification that learning has accomplished its purpose". For instance, if a learner has set out to learn Geography calculations, feedback is provided when he or she actually calculates with accuracy and correctness. If the purpose of learning has been to acquire the numeracy skills of finding the area of the map, feedback is provided by the successful computation of the area of one or more maps. Hamachek (1990:409) suggests certain guidelines on the nature of feedback that should be given by effective teachers. He states that:

feeding back can be used by both the teacher and the learner. The learner can use feeding-back for self-assistance and self-regulated learning. It can be used for correction of problematic behaviour. To assist the learners to develop skills, it is necessary to comment on their behaviour. Observing behaviour and giving feed-back requires skills on the part of the teacher that needed to be developed.

Moreover, Barnett, Chambers and Hughes (1987:13) suggest that to be most effective, feedback should, if possible, be given immediately after the event.

In the educational setting, informative feedback can be supplied in the form of test results, correction of errors and teacher's responses to learner's activities. Teachers, too, receive feedback. This means of assistance can be used in assisting performance of teachers when their work is being observed and evaluated. Feeding-back assists in the determination of the required standard of performance. Information that is provided by the teacher to the learners is compared to a standard which learners must strive for. During the interactive teaching, the responses of learners are weighed against the required standard. In the teaching of Geography numeracy skills, it is important that learners get feedback about their accuracy in measurements of distances and angles for map orientation. Standards can also be provided by modeling and simple instructions.

#### *3.7.4.2 .Questioning :Tharp and Gallimore.*

Perkins' (1992) "informative feedback" is linked with Tharp and Gallimore's (1988) "questioning" as a means of assisting performance. Feedback can be provided by means of asking questions after a lesson has been taught. It is the questioning that will make learners aware whether or not they are progressing. Feedback is another form of reinforcement which encourages the learners to strive for correct procedures in the solving of problems especially in Mathematics and Geography numeracy skills. Biehler and Snowman (1993:357) contend that delayed feedback is as important and effective as immediate feedback. When learners are given questions to be answered as homework, immediate feedback is impossible. Biehler and Snowman (ibid:356) maintain that "although quick knowledge of correctness (feedback) is described in many types of learning, some tasks are so lengthy or complex that a proper

evaluation precludes immediate feedback”.

Questioning is used in all assisting interactions. Although teachers frequently ask questions in the classroom, most of them are concerned with the recall of facts and the level of comprehension of learners. Few questions require discussion or another form of response. (Tharp and Gallimore 1988:58). Tharp and Gallimore further compare the ways in which questions assist and the ways in which instructions assist. They found that questioning and instructing may be functionally equivalent and produce the same effect. In Geography teaching, a teacher may ask :“ What is the distance in kilometres between point A and point B ?” or “Tell me, the distance between point A and point B”. In the same process of teaching there is a distinction between questions and instructions. If a teacher wants action but phrases the direction in the interrogative form, it is likely that he or she will get a reply in language and not in action. For instance, if a teacher asks the question : “Will you measure the distance between point A and point B ?” The learner could respond by answering “Yes” and not pursue the required action. But the instruction “Measure this distance,” requires a reply in action and not in linguistic form.

Questioning is a powerful means of assisting performance if it is used appropriately. Gallimore and Tharp (1991:181) say “ Questioning explicitly calls for an active linguistic and cognitive response. It provokes creations by the pupil”. They also compare the use of questioning and the lecture method. In the Geography context, a teacher can either ask, “What is the meaning of intervisibility ?” or give a lecture on the concept. Gallimore and Tharp (1991:181) found

that there are more advantages when questioning is used. The first advantage is that “there is a mental and verbal activation of the pupils, which provides them with practice and exercise.” (ibid). The second advantage is that the teacher will be able to regulate the students’ assembling of evidence and use of logic. If a teacher merely lectures, he or she will not know the student’s line of thinking.

Tharp and Gallimore (1991) suggest that there are two forms of questions. The first are assessment questions. These questions are used to assess the level of ability of the learners which allows them to perform tasks without the assistance of the teacher. Assessment questions have a tone of instructing because the ability of the learners can be assessed through the action performance of a task. In the Geography teaching, a teacher may ask : “ What is the feature on the photograph marked X ?” For learners to arrive at an answer, they will use several deductions which differ from pupil to pupil. It is unfortunate that the teacher will not know the different “thinking” of learners before they arrive at answer. To have an idea of cognitive manipulation of learners, the teacher may ask for an elaboration of the answer. He or she may ask for evidence to substantiate the considered answer. The value of assessing questions lies in the judgement about the success or weakness of a particular method that was used in the teaching of a particular aspect. This enables the teacher either to recur to previous teaching or proceed and assist the learners in their ZPD. Assessment questions do not directly assist performance. They assess the performance and thereby give the teacher an opportunity to decide about assistance.



The second form of questions are assistance questions. These questions are intended to help the learners. An assistance question not only provokes the learners cognitive ability, but also propels the mental operation to higher levels of insight. The teacher may ask questions from information given in the previous lesson at the beginning of the lesson. The assisting questions enable the learner to rethink. One can hear a learner saying “Mh ! I never thought it like that”. This provokes the learners to think more. Although these questions do not bring new behaviour, they assist performance and therefore feature in Perkins’ feedback provision.

### 3.7.5 Perkins’ strong motivation.

#### *3.7.5.1. The Role of Motivation.*

It is the view of psychologists that humans are never unmotivated because each person is ever motivated to maintain and enhance feelings of self-worth. This, implies that “...the key to motivation lies within the individual, as some internal drive or need, rather than outside in something that is done to motivate him” (Reilly & Lewis 1983:245). Teachers’ statements, therefore, about some learner(s) being unmotivated are incorrect.

Since much of what is learned in schools is basically uninteresting to most students, there is a need to apply a variety of extrinsic incentives or motivation. These extrinsic incentives for learning originate, according to Seifert (1991:247) “...from a desire to impress others”. When extrinsic motivation is applied to learning, learners are subjected to a variety of reward systems which include grades, praise, gold stars, special privileges, prizes and other rewards which are external to the activity of learning. On the contrary, intrinsically motivated students are

influenced by their personal interest, satisfaction and enjoyment of being engaged in an activity which is rewarding in itself. “For these students, the favourite subject itself has enough intrinsic incentive value to motivate them to learn.” (ibid).

Clarizio, Craig and Mehreus (1987:310) further indicate that there is negative motivation which includes fear of failure, learned helplessness, negative attitudes and other related problems associated with expected failure outcomes as a result of low ability. In an attempt to counteract this negative motivation, Clarizio, et al (ibid) speculate on how theories of motivation would increase students’ motivation to learn:

Social learning theorists would program for continuous progress and consistent success, achievement motivation theorists would train students to set challenging but achievable goals, and attribution theorists would train students to attribute poor performance to insufficient effort rather than lack of ability.

For teachers to increase students’ motivation to learn so that learning is effective, a variety of strategies can be used depending on the context in which teaching takes place, and upon the characteristics of students. In this regard, Siefert (1991:247) suggest three strategies :

- select activities that are moderately challenging.
- link the subject topics to student’ pre-existing interests.
- de-emphasize external rewards.

Teachers' methods of teaching should not only include the presentation of clear information but should be accompanied by techniques which assist in enhancing motivation among students. Slavin (194:383) provides means of presenting material in an appealing way so that the students' motivation to learn is increased. These include :-

- arousing students' interest.
- maintaining students' curiosity.
- using a variety of presentation modes.
- letting students set their own goals.
- stating clear explanations.
- giving clear, immediate and frequent feedback.
- determining the value and availability of rewards.

One method suggested by both Hermann (1996:162) and Collins (1994:264) that can be used in a secondary school Geography class to interest students in Geography is to develop a spatial perspective. This is done by using examples from local Geography in order to illustrate some geographic concepts. One example could be to have learners construct a detailed map of their school and the surrounding features. Hermann (ibid:163) emphasizes that the teacher must "have them make measurements using paces to determine distance". Once learners master the mapping of their own school, they experience the spatial nature of Geography.

In view of these strategies and means of presenting learning material, it is evident that motivation has a significant role to play in teaching and learning and in the acquisition of

mastery and performance goals. Such goals provide students with motivational orientations.

### *3.7.5.2 Contingency Management :Tharp and Gallimore*

Perkins (1992:05) discusses “strong intrinsic or extrinsic motivation” as his fourth condition for learning. He places more emphasis on intrinsic motivation than extrinsic motivation. Learners who are intrinsically motivated value learning for its own sake. They are interested in school tasks regardless of the expected rewards, and the learning of such tasks is rewarding in itself. The school or classroom activities that are rewarding in themselves stimulate learners to value and enjoy the actual process of working on academic tasks because they contribute to other achievements that satisfy the learner in one way or another. On the other hand, through extrinsic motivation, learners are engaged in activities and are induced to learn by being offered rewards of different kinds. Hamachek (1990:265) cautions against the excessive use of this motivational model in that it “...overpromotes the values of the teacher and underestimates the interest of the student”.

Perkins’(1992) approach to motivation appears to endorse Tharp and Gallimore’s (1988:51) “contingency management” which is described as “...the means of assisting performance by which rewards and punishment are arranged to follow on behaviour, depending on whether or nor the behaviour is desired”. Positive reinforcement may be used to encourage the repetition of a particular behaviour. Such a reinforcement may be used in verbal rewards such as praises and encouragement; in non-verbal rewards such as nods, smiles and back-patting; in token rewards such as marks, stars, medals and certificates. Negative reinforcement may also be used

to reinforce desired behaviour. For instance, a teacher might tell learners that they will not fail if they work hard. To avoid failure, they do the work well. Contingency management assists performance by reinforcing desirable behaviour and actions and weakening and discarding the undesirable ones. In the teaching of Geography numeracy skills, such a means can improve the performance of the learners through the ZPD by reinforcing behaviours and actions of learners that enhance the learning of such skills.

### 3.8 CONCLUSION.

In the survey of literature related to the methods of teaching Geography numeracy skills in the Standard 10 class, it is proposed that Perkins' (1992) conditions for learning can be put into practice using Tharp and Gallimore's (1988) means of assisting performance. In other words, if teachers provide clear information, give learners opportunities to think with knowledge and use it in various situations, monitor their performance and motivate them, there is every possibility for an increased performance. The six means of assisting performance: modeling, instructing, cognitive structuring, informative feedback, questioning and contingency management can be used to facilitate learning.

These techniques of teaching can be used not only to augment the teachers' methods but also to assist the teachers in their quest for improved performance in learners especially in subjects that constantly depict low attainments. Geography is one of the subjects that needs this assistance from teachers using these techniques. It can be anticipated that when they are used properly, the attainment in the Geography numeracy skills will be improved.

## **CHAPTER 4. RESEARCH METHODOLOGY AND PROCEDURE**

### 4.1 INTRODUCTION.

The purpose of this chapter is to illustrate the major methodological concepts and principles of classroom research which enabled the researcher to conceptualize, plan and conduct this investigation. Included in this chapter are the methodological aspects of classroom research which are concerned with identifying patterns of teacher behaviour that are considered desirable in classroom teaching. This identification of patterns of teacher behaviour is based ".... on the premise that correct teacher behaviour should result in pupil progress"

(Mouly 1978:221).

The rationale behind the use of the observation technique in this study, the purpose of classroom observation and some of the different methods for collecting observed data constitute part of the discussion. The research design encompasses the drawing of a sample and data-collection methods which are consistent with the research question. The procedure includes the clarification of plans related to the problems under investigation. This chapter concludes with a description of problems encountered by the researcher during the period of observation, and ways in which were solved.

### 4.2 METHODOLOGICAL ASPECTS RELATED TO CLASSROOM RESEARCH.

#### 4.2.1. The value of classroom research.

The need for research on how teaching occurs in the classroom is intended to help educators

to improve the conditions and the quality of learning and teaching in schools. It is on the strength of this ideal that the actual transactions between teachers and learners should be documented. The value of classroom research has been realized on a small scale by teachers, who, though they are part of the classroom, have conducted classroom inquiry as a regular part of their roles as teachers. This, in many instances, is intended for self-analysis and comparison of one's teaching strategies with those of others. Such a reflective form of teaching is indispensable for the previously learned naive theories of teaching and belief systems to be eradicated. At the same time, one may learn good techniques of teaching from others so as to build one's personal framework. This will not only assist in decision-making about strategies to be used in the classroom but will help in the making of wise choices of effective modes of teaching.

In Curriculum 2005, classroom research will entail the observation of a variety of methods used by teachers in order to accommodate individual differences as determined by the learners' abilities and efforts. This implies that the demand for classroom research in the implementation of Curriculum 2005 will be more pressing than ever before since the learner will also be involved in the choice of the learning material. Regarding this classroom research, Goswami and Stillman (1987:ii) point out the gains achieved by such teacher researchers. These are :-

- their teaching is transformed in important ways : they become theorists, articulating their intentions, testing their assumptions and finding connections with practice.
- their perceptions of themselves as writers and teachers are transformed. They step up their use of resources; they form networks; and they become more active

professionally.

- they become rich resources who can provide the profession with information it simply doesn't have.
- they become critical, responsive readers and users of current research ... and more authoritative in their assessment of curricular, methods, and materials.
- they can study writing and learning and report their findings without spending large sums of money.
- they collaborate with their students to answer questions important to both, drawing on community resources in new and unexpected ways. This provides students with intrinsic motivation for talking, reading and writing.

Although Goswami and Stillman (1987) mainly refer to action research, their points also hold for general classroom research since both depend on the observation technique to guide the study of classrooms. This means that classroom research goes beyond given or absolute knowledge.

#### 4.2.2 The purpose of classroom observation.

Montgomery & Hadfield (1989:07) state that the three main purposes for classroom observations are :

- To appraise the performance of teachers.

Despite the widespread rejection of the traditional bureaucratic, closed, authoritarian and supervisor-driven class inspection of teachers, the evaluation of teacher performance still



remains a necessity than a matter of choice. Information about teachers and their work is vital to the employers and the parents who are tax-payers. The new teacher appraisal system, the 360-degrees technique, is currently being negotiated in the Education Labour Relations Council. According to this new appraisal system, observers ( to be called raters) may include subject advisers, school management, personnel, fellow teachers, learners and even parents. The various raters evaluate the teacher on the behaviour or work incidents that they have directly observed. Rasool Mahomed (The Teacher, May 1997) further explains that “pupils are in the best position to evaluate the teacher's ability to manage time in the lesson or comment on the teacher's use of language since they interact daily with each other”. Such an evaluation leads to accountability to a wider scope than the traditional inspection as several stakeholders are involved.

- The improvement of teacher competency.

Another purpose of classroom observation is for teachers to improve their classroom practice. This classroom observation is not only beneficial in the academic and professional preparation of intending teachers but also to those already employed who still have traditional skills from their initial training. For teachers to be effective in their daily work, teaching and learning are to be judged in terms of standards and quality.

- Understanding what happens in the classroom.

This form of observation is concerned with activities that take place in the classroom while the focus is on teaching and learning. The observer may be interested in the relationships between

students and the teachers, and the relationships between events such as questioning, and the consequences thereof. Such an observation therefore, places emphasis on teaching rather than appraisal of the performance of the teacher.

Croll (1986:09) in his identification of purposes of systematic classroom observation cites the following :-

- Providing a Representative Description of Classrooms.

The purpose of classroom observation as a research approach is to provide a descriptive account of representative samples of classroom in order to make generalization about classrooms in general. The main purpose of this research is to provide reports on selected features of interaction and on the teaching methods used by teachers.

- Measuring Teaching Effectiveness

A second purpose of systematic classroom observation is to measure the effectiveness of different approaches used by teachers. This process-product research is not only confined to earlier notions of school results being related to the effectiveness of teachers but also to other classroom processes.

- Monitoring Teaching Approaches.

Systematic classroom observation may be used to measure success of certain teaching approaches in relation to other classroom processes. This may take the form of comparison.

For example, the amount of praise may be compared with the level of co-operation among students.

- In-service Teacher Education.

Teachers involved in in-service work may use systematic classroom observation for any of the above purposes but can also be use it to improve aspects of their own practice.

- The Initial Training of teachers.

Systematic observation can also be used in colleges of education to give students feedback on their own teaching in real classes during their teaching practice, or feedback can be given during peer observation or in their learning to design an observation schedule.

In terms of new envisaged changes, as propagated by the Education Department in how classroom activity must be observed in South Africa, a new draft Document by SADTU/DET/Teacher organizations (1995) has been proposed and the following of such classroom observation aims include the following:-

- To bring about the optimal personal development of educators and thereby enhance the quality of the education system as a whole.
- To serve as a point of departure from which the development of educators can be undertaken in order to realize their optimal potential.
- To improve the educative and teaching ability of educators through support and development programmes.

- To promote the competency of educators for the purpose of optimum utilisation, promotion and corrective measures.
- To determine the success of teacher training and development programmes and, where necessary, to make recommendations.
- To maintain maximum accountability to all stakeholders.
- To establish a nationally recognised appraisal system.

The rating for the appraisal is not intended for classroom research but contains criteria for the appraisal of teachers which replaces the old bureaucratic system of inspection. However, the aims of classroom research based on classroom observation can contribute positively in the development of an effective appraisal system for the development of teachers specifically and the upliftment of education in general.

From this discussion, it is clear that classroom observation is indispensable in the learning for effective teaching. One who wishes to understand what life is like in classrooms, must spend time in observing classroom events. Such observations expose the observer to various types of teaching under a variety of circumstances in order to differentiate between effective and ineffective teaching.

#### 4.2.3 The approaches to classroom research.

Croll (1986:01) states that observational research can be divided into two approaches, namely, systematic observation and the ethnographic approach.

#### 4.2.3.1 *Systematic observation.*

Anderson and Burns (1989:48) state that the two fundamental modes of inquiry in the social and behavioural sciences are confirmatory and interpretive. They further argue that systematic classroom observation is sometimes treated as synonymous with Flanders' (1970) Interaction Analysis Categories (FIAC). Systematic observation is described as a process whereby an observer devises a systematic set of rules and procedure for describing events and interactions, recording and classifying classroom events and reporting the results in quantitative terms (ibid.p.13) Although this type of approach focuses on the quantitative form of research, Sherman and Webb (1988:18) suggest that in order to broaden the method of research a comprehensive theory that unites different modes of qualitative and quantitative inquiry should be developed.

Systematic observation involves the spending of a period of time observing a variety of classrooms for a particular purpose. Descriptions of classrooms also involve abstracting certain aspects which are considered to be relevant for a particular investigatory purposes. It is the sampling of selected features of activities and interactions in the classroom and setting of predetermined categories that assists in the elimination of subjectivity which normally occurs when the researcher describes events. Croll (1986:05) maintains that "once the procedure for recording and criteria for using categories have been arrived at, the role of the observer is essentially one of following instructions to the letter and any observer should record a particular event in an identical fashion to any other".

Since systematic observation is concerned with quantitative analysis of data, it is associated with what Biddle and Anderson (1986) describe as the confirmatory mode of inquiry. According to their view, researchers operating within the confirmatory mode of inquiry emphasize the testing of hypotheses which are deductively derived from theory prior to data collection and confirmed or disconfirmed, based on statistical analysis of empirical evidence (ibid). This approach is further commended by Anderson and Burns (1989:61) when they re-affirm that it has been a dominant system of inquiry in education because it has been controlled, quantitative, operational, objective, empirical and replicable research. Furthermore, it takes the position that reality exists independently of the perceiver and that it is the duty of the researcher to discover the facts of the external world. (ibid).

#### *4.2.3.2 Flander's interaction analysis categories (FIAC).*

This signifies a procedure developed by Flanders (1970) who sees the operations of the classroom in terms of an on-going process of teacher-student and student-student interaction. Flanders directly categorizes classroom behaviours, first, into teacher talk (seven categories) and student talk (three categories) and further divides teacher talk into direct and indirect influence. One important feature of Flanders' interactional analysis is the coding of observed events (taken at 3-second intervals) according to a series of four decision steps. The observer has to decide first whether he or she can hear and understand what is being said in the classroom, secondly who said it, the teacher or a student." The third decision concerns whether the utterance represents an initiation or a response, while the final decision pertains to the nature of the initiation or response itself " (Anderson and Burns 1989:151).

Observations are then tabulated in pairs in a two-way chart so as to show the continuity of communication and the tally summary for two separate classroom observation. The ten analytic categories which make up the system are reflected in the following table:

Table 1: Flander's interaction analysis categories. (FIAC) - Flanders (1970)

Teacher Talk	Response	<p>1. <i>Accepts feeling.</i> Accepts and clarifies an attitude or the feeling tone of a pupil in a nonthreatening manner. Feelings may be positive or negative. Predicting and recalling feelings are included.</p> <p>2. <i>Praises or encourages.</i> Praises or encourages pupil action or behavior. Jokes that release tension, but not at the expense of another individual; nodding head, or saying "Um hm?" or "go on" are included.</p> <p>3. <i>Accepts or uses ideas of pupils.</i> Clarifying, building, or developing ideas suggested by a pupil. Teacher extensions of pupil ideas are included but as the teacher brings more of his own ideas into play, shift to category five.</p>
		<p>4. <i>Asks questions.</i> Asking a question about content or procedure, based on teacher ideas, with the intent that a pupil will answer.</p>
	Initiation	<p>5. <i>Lecturing.</i> Giving facts or opinions about content or procedures; expressing <i>his own</i> ideas, giving <i>his own</i> explanation, or citing an authority other than a pupil.</p> <p>6. <i>Giving directions.</i> Directions, commands, or orders to which a pupil is expected to comply.</p> <p>7. <i>Criticizing or justifying authority.</i> Statements intended to change pupil behavior from nonacceptable to acceptable pattern; bawling someone out; stating why the teacher is doing what he is doing; extreme self-reference.</p>
Pupil Talk	Response	<p>8. <i>Pupil-talk—response.</i> Talk by pupils in response to teacher. Teacher initiates the contact or solicits pupil statement or structures the situation. Freedom to express own ideas is limited.</p>
	Initiation	<p>9. <i>Pupil-talk—initiation.</i> Talk by pupils which they initiate. Expressing own ideas; initiating a new topic; freedom to develop opinions and a line of thought, like asking thoughtful questions; going beyond the existing structure.</p>
Silence		<p>10. <i>Silence or confusion.</i> Pauses, short periods of silence and periods of confusion in which communication cannot be understood by the observer.</p>

\*There is *no* scale implied by these numbers. Each number is classificatory; it designates a particular kind of communication event. To write these numbers down during observation is to enumerate, not to judge a position on a scale.



#### 4.2.3.3 *The ethnographic approach.*

This is often described as an anthropological observation as it relates to social anthropology, psychiatry and participant observation research in sociology. Smith and Geoffrey (1968) describe it as a micro ethnographic approach because it involves the presence of an observer for prolonged periods in a single or small number of classroom. Barker (1968) views it as an ecological approach since ecological psychologists study naturally occurring behaviour and the effects environment have on that behaviour.

Methodologically, anthropological classroom studies are based on participant observation during which the observer not only observes but also talks with the participants. To record his or her observations, the observer compiles field-recordings in an unstructured and open-ended format. The holistic framework of the ethnographic approach becomes evident when the researcher accepts the complex scene he or she finds in the classroom and regards this totality as his or her data base. In this exercise, no attempt is made to manipulate, control and eliminate extraneous variables. This does not mean that the researcher views every aspect of this totality as a subject of analysis. The area of inquiry is systematically reduced in order to accommodate the relevant issues of the investigation and to progressively focus on those classroom features which signify the phenomena under study.

The ethnographic approach is closely related to what Anderson and Burns (1989:76) term "interpretative inquiry". Interpretative inquiry is more descriptive than confirmatory research because it seeks to understand the inner perspective and the meaning of actions and events of

those being observed and does not rely on statistical generalization generated from normative data.

Everston and Green (1986) offer the following recommendations when ethnographic approaches are preferred :-

- Observations must take place over a fairly lengthy period of time in the same classroom or school. The events observed today may only be understood within the context of the events that occurred yesterday and / or those expected to take place tomorrow.
- Observers should formulate hypotheses based on the evidence gathered during the observation.
- Observers should learn to converse with teachers and students in the classroom so that these participants talk freely and openly. Conversation, before or after class, should not disrupt the classroom nor disturb the participants.
- Observers should use whatever instruments they find useful in aiding them in the collection of the needed evidence.

Such guidelines are indispensable in the observation of classroom activities and behaviours over a long period of time in a particular classroom or school.

#### 4.2.4 The preferred approach in this study.

For the purpose of this discussion, classroom research has been divided into two broad approaches whilst being mindful of the diversity of variables that may be added in the expansion of research paradigms from time to time. In order to focus our study of classroom activity for flexible observation and to provide accurate description of data, the approach that was used for collecting data in this investigation was the ethnographic approach. The rationale for the selection of this approach is based on its main characteristics in which Borg and Gall (1983:492) emphasize: during the ethnographic study "... the observer uses continuous observation, trying to record virtually everything that occurs in the setting being studied".

choice  
methodology

Avalos (1986:23) argues that this research approach has the "closeness of the phenomenological approach" which views knowledge as a constructed social reality. Since the ethnographic approach emphasizes the description and understanding of processes in social events, it can be applied in the school situation by analysing the complexities of school life and the conditions which determine the pupils' success or failure. That is why the ethnographic practice when applied in school situations can be differentiated into research steps or events. These may include observation, description of what has been observed and interpretation of recorded data. Although ethnographic research covers major aspects of the culture of a given society, in education it is concerned with an intensive and in-depth study of limited and specific topics, the scope of which differ from one school system or situation to another. Using this approach was considered relevant and fitting in this study because of the fact that the ethnographic paradigm is not rigid in the analysis of classroom behaviour in terms of the

sociocultural milieu of a specific classroom.

Sherman and Webb (1988:80) argue that studying human behaviour and events in a cultural context entails two methodological aspects :-" The first requires observation of not only events relevant to the framework of an immediate research setting but also of their relationship to a broader sociocultural milieu which remains the background of the immediate setting". The second aspect involves sociocultural knowledge which is used by participants in communication with others.

In this way, the ethnographic approach assists in the study of events as they occur in natural settings or the classroom context is viewed in terms of the natural human experience. Anderson and Burns (1989:67) analyse such an interpretative inquiry as being "... more naturalistic than controlled, more qualitative than quantitative, uses concretizing concepts rather than operational definitions, is more subjective than objective, more rational than empirical and concerned more with context than replication. Such an approach is strategically inclusive of all the necessary aspects of the investigation. Some classroom events may be anticipated while others may be totally unexpected".

Further, Anderson and Burns (1989:82) describe the qualitative orientation of the ethnographic approach which underlies the main methodological consideration of this study. In their examination of this approach they outline three paradigmatic premises that describe its qualitative nature. These are :-

First, ethnographers are interested in the sociocultural pattern of human behaviour rather than quantification of human events. Secondly, ethnographic research emphasizes the integration of particular events into a coherent and qualitative meaningful pattern where the relationship of events is established. The third premise involves the ethnographers' focus on the ongoing settings in sociocultural contexts, such as communities, educational institutions, and classrooms where events occur as human interaction takes place. It is evident that this research approach is aligned with the notion advocated by Clark (1996:115) that a school is a learning community. In his exploration of learning communities, he maintains that each classroom is but a mini-society within the larger society of the whole school. "If the class fails to develop as a mini-learning community, there is no hope of the school itself becoming a macro learning community" (ibid).

#### 4.2.5 Preferred methods of collecting data in this study.

Apart from the direct and descriptive observation mentioned previously, other methods that were to be used to collect observational data included the following :-

##### 4.2.5.1 *Field recordings*.

In addition to observing classroom actions and events, the researcher compiled field recordings with the intention of reporting observations, reflections and problems. This included jotting down notes as the lesson progressed. Hopkins (1985:116) identifies four uses of field notes in classroom research which are :-

- They can focus on a particular issue or teaching behaviour over a period of time.

- They can reflect general impressions of the classroom and its climate.
- They can provide an ongoing description of an individual child that is amenable to interpretation and use in case study.
- They can record the development of teachers' performance in teaching.

One advantage of field notes is that they provide an on-going record of the continuity of incidents that occur during the lesson. These notes result from speeches, lectures, class discussions, conversations and meditation. Field notes are also indispensable because they may be used to generate discussions and insight. Such notes need to be detailed but should be complete so that the observer is able to reconstruct the events that occurred during classroom observation. Anderson & Burns (1989:142) in support of the field notes made during classroom observation, state that "the primary strength of field notes made by observers operating with the ethnographic or naturalistic tradition is that they occur in the classroom from the point of view of the participants themselves."

#### *4.2.5.2 Audiotape recordings.*

During the classroom observations, the non-availability of a participant observer was redressed by the use of an audiotape to record the verbal interactions between the teacher and the learners. It was expected that the teacher-student interactions may occur with high frequency with the result that the necessary observational data may be lost. When the classroom events were recorded by means of an audiotape, that gave the researcher an opportunity to replay these events several times so that information should be studied conveniently in his own time. The

recordings of the audiotape constituted the primary data.

The researcher could enlarge on the field recordings after the observations. Recordings also enabled the researcher to record behaviour at the time of occurrence. The secondary form of data included photographs, maps, globes and whatever geographical information that is shown on television, film strips and discussed on radio. Such procedures were intended to give a continuous account of the classroom activities and interactions. The immediate recording of observations in class were intended to minimize errors due to selective forgetting and bias and the missing of significant observations. These observational methods provided a direct procedure for studying various aspects of human behaviour in different lessons as the audio-visual picture of the situation was obtained. Such method were considered the only satisfactory way to gather valid and reliable data in a typical classroom and to observe the process of mediation during the interaction between the teacher and learners as the lesson progresses.

#### *4.2.5.3 The observation schedule.*

The researcher compiled an observation schedule with the intention of examining the extent to which the teachers assisted performance of learners during the lesson-presentation. The teachers' assistance of learners would be viewed against the background of the variables to be observed. The list of items drawn for the observation schedule demonstrates the categories intended for the observation.

The idea of compiling an observation schedule emanated, firstly, from the consideration of checking the occurrence of behaviours relevant to the study whenever they occurred, so that later inferences could be made. Secondly, the researcher believed that the use of the ethnographic research, which requires continuous observation and recording, would be compatible with a predetermined categorized observation schedule. The following items are explained in terms of what was expected from both the teacher and the learner during the observation sessions :-

Table 2 : Categories and items of the observation schedule.

CATEGORIES	ITEMS
1.CLEAR INFORMATION	<ul style="list-style-type: none"> <li>-The teacher presents information clearly.</li> <li>-The teacher assists performance.</li> </ul>
2.TEACHER-LEARNER INTERACTION	<ul style="list-style-type: none"> <li>-The teacher guides the interaction between him or her and the learner (s).</li> <li>-The learner initiates the interaction.</li> </ul>



3.PROGRESSION	<ul style="list-style-type: none"> <li>-The teacher assists the child in the task performance.</li> <li>-The learner takes control of task performance.</li> <li>-The learner reverts to previously-known art of performing the task.</li> <li>-The teacher assists performance.</li> </ul>
4.MODELING	<ul style="list-style-type: none"> <li>-The teacher demonstrates positive behaviour modeling by the learners.</li> <li>-Learners imitate the presentation of “clear information”.</li> <li>-The teacher assists performances.</li> </ul>
5.INSTRUCTING	<ul style="list-style-type: none"> <li>-The teacher sets standards of performance.</li> <li>-The teacher gives information.</li> <li>-The teacher assists performance.</li> </ul>
6.QUESTIONING	<ul style="list-style-type: none"> <li>-The teacher asks questions that assess the performance of learners for further guidance.</li> <li>-The teacher asks questions that assists the learner progress.</li> <li>-The teacher assists performance.</li> </ul>

7.PUPIL ACTIVITY	<ul style="list-style-type: none"> <li>-The learner takes part in the lesson.</li> <li>-The teacher assists performance..</li> </ul>
8.COGNITIVE STRUCTURING	<ul style="list-style-type: none"> <li>-The teacher provides a structure for the learning and teaching.</li> <li>-The learners utilize their own cognitive structures.</li> <li>-The teacher assists performance.</li> </ul>
9.INFORMATIVE FEEDBACK	<ul style="list-style-type: none"> <li>-The teacher monitors the performance and progress of learners.</li> <li>-The teacher assists performance.</li> </ul>
10.FEEDING BACK	<ul style="list-style-type: none"> <li>-The teacher determines standards of performance.</li> <li>-The teacher assists performance.</li> </ul>
11.MOTIVATION	<ul style="list-style-type: none"> <li>-The teacher establishes conditions for learning.</li> <li>-The teacher assists performance.</li> </ul>
12.CONTINGENCY MANAGEMENT	<ul style="list-style-type: none"> <li>-The teacher manipulates the behaviour of the learner.</li> <li>-The teacher assists performance.</li> </ul>

#### 4.2.5.2 *Triangulation.*

This is a method of verifying data. Such verification leads to the confirmation or otherwise of data or the theoretical hypothesis. Harris and Bell (1986:66) state that one of the methods of triangulation is to use three or more different information- collecting techniques. Ideas which are collected from two or more methods have more reliability than one.

In this study, the researcher used three methods for collecting data namely, audio tape recordings, field recording and the observation schedule, though the latter presented the researcher with problems which will be discussed later. During the presentation of lessons, the researcher took audio tape recordings of both the teacher's voice when teaching, and the learners' voices when either answering or asking questions. The purpose of this tape-recording was to counteract the problem of the rapidity of teacher-student interaction so that all necessary observational data were recorded.

While tape-recording occurred without any interruption, the researcher was simultaneously taking notes of his observation, impressions and interpretation of the classroom events. Such field recordings were done from the beginning to the end of the lesson and care was taken not to mix the observations of different lessons.

Apart from field recording, the researcher had to record precategorized behaviours reflected on the observation schedule. This meant the ticking on the observation schedule of observed behaviours based on the teacher's and of the learners' responses. It became tedious and

cumbersome for the researcher to record field notes, make ticks in the observation schedule and at the same time observe. The researcher decided to abandon the observation schedule and relied on the field recordings and his direct observation.

The use of so many methods for data collection was aiming at obtaining a broader picture of classroom observation for a deeper interpretation of results. The researcher was bound to make instant decisions on what to write down and what to omit.

#### 4.3 THE RESEARCH DESIGN AND PROCEDURES.

##### 4.3.1. Administrative procedures.

After the analysis of Standard 10 subject allocation in three districts in the Eastern Cape, permission for conducting classroom research was sought from the three District Managers (cf. Appendix 2). The analysis of curriculum in three districts was intended to select schools that were offering Geography from Standard 8 to Standard 10. Such selected schools would form part of the research project. After permission was granted, four Geography teachers from three different Senior Secondary schools were consulted and supplied with topics intended for classroom observation. The Geography teachers were mostly well-qualified to graduate level in this field and the topics selected included those intended for both Standard and Higher grade. The teachers were assured of the confidentiality of the research project, an exercise which encouraged them to co-operate.

#### 4.3.2. The research setting.

The field of investigation was confined to two rural and one urban senior secondary schools in the Eastern Cape which offered Geography as one of the subjects at Standard 10 level. In this study, the term urban refers to a school which is located within the boundaries of a town or a township. A rural school refers to a school which is located in an area where farming is the main activity or occupation.

Two teachers involved in this study were of Central African origin (Ghana and Uganda) who were employed on a contract basis to alleviate the problem of staff shortage in key subjects such as Geography. Since they were from foreign countries, their school, tertiary education and their teacher training was received either from their own countries or in Britain. The other three teachers were South African Blacks. (The term "Black" should not be misconstrued as bearing a discriminatory undertone but it is used for purposes of clarification and identification.)

The classrooms in which the research was conducted were traditional in nature. The layout of such classrooms guaranteed a uniform instructional programme for all learners. In a traditional classroom, the arrangement of desks is uniform, with students facing the front and the teacher's table located in front. The students of such schools represented a wide range of ages and abilities. There were generally more non- mathematical students in all the three schools involved in the study, there were also more female students than male students.

(c.f. List of Tables).

#### 4.3.3 The goal of the research.

The observational research which had been chosen for this study was designed to evaluate the methods used by teachers in their teaching of numeracy skills in Standard 10 Geography. In order to collect the qualitative data, direct and unstructured observation of lesson presentations in various settings of three selected schools was undertaken by the researcher. Because of limits of time, the researcher had to adopt a non-participatory approach during the lesson presentation and had to present himself in class and make field recordings and tape recordings of the lessons. It was intended that thorough understanding be gained of the classroom activities and the context in which the teacher-pupil interaction occurred. In order to set the students at ease and to create a sound relationship with them, a short briefing on the aims of the recordings was made without divulging the essence of the investigations.

This seemed a useful strategy for this study as Blyth (1995) and Prinsloo (1996) have produced a sound knowledge base for understanding classroom observation. Blyth (1995) examined the extent to which teachers make use of their pupils' prior knowledge to assist them in their learning. Such a study, based on a Vygotskian perspective, analysed three classroom interactions namely, instruction, questioning and cognitive structuring. The research design involved the observation of a series of lessons in three primary school classrooms. Prinsloo (1988) also developed a research design that hinged on the observation of interaction between the teacher and pupils during the English Second Language lessons. Because of the complexity of classroom activities and variables, such classroom observations will always entail the abstraction of certain predetermined elements which become the focus of the investigation,

since the whole complexity of a classroom cannot be effectively observed at once.

#### 4.3.4 Drawing the sample.

The sample for the study was drawn from classes in which Standard 10 Geography was taught. The schools fell under the jurisdiction of the Education Department in the Eastern Cape Province of Republic of South Africa. This sample included Geography teachers and learners. Six groups of Geography learners and their respective teachers were the final sample group. This sample was selected because it was in the home province of the researcher. The selected sample consisted of:

Black, Xhosa-speaking learners of both genders, age between 16 and 25 years old as at 30 August 1997, from predominantly a rural area background, all day-scholars doing Standard 10 Geography which comprises one of the six subjects.

##### 4.3.4.1 *The selection of sample.*

Three senior secondary schools which belonged to the ex-Transkei Department of Education were selected. Factors that determined the selection of such schools included the following :

- Proximity with regard to the tarred road to avoid muddy roads.
- Consideration of travelling expenses, time wastage and honouring of the school time-table.
- Placement of schools in areas that are accessible and thus characterized by a low absentees rate among both teachers and students.

#### 4.3.4.2 *Description of samples.*

For the purpose of this study, the three schools will be designated as school A, school B and school C.

##### School A

A rural senior secondary school (Standard 8 - 10) in which there were two groups of students doing Geography at higher grade. One group was doing Geography and Mathematics and was termed Standard 10A. Another group was doing Geography without Mathematics and was termed Standard 10B. The teacher who was responsible for these two was a Central-African Black. It appeared he was overloaded with work as he had to contend with approximately 80 students in Standard 10 while he also taught more than 100 Standard 9 Geography students. The rate of absenteeism was very high among students as the local land-ladies who supplied them with accommodation for hire were more concerned with monthly rents than school attendance.

The curriculum consisted of two streams, the Humanities with History and Agricultural Science (for boys) and Needlework and Clothing (for girls) as key subjects and Sciences which included Mathematics and Physical Science as main subjects. Two languages (i.e. Xhosa and English), Biology and Geography were compulsory subjects.

##### School B

A rural senior secondary school whose teachers originated from different cultural backgrounds i.e. some were Indians, others were Ugandans while others were local Xhosas. Three teachers



whose lessons were observed (one female and two males) were responsible for teaching Geography in three different groups of Standard 10 students. Although the curriculum was flexible with several options in Humanities and Commerce, Geography at Higher grade remained a compulsory subject. The class size per teacher in these three groups was in the ratios 10A 1:27, 10B 1:72 and 10C 1:18.

#### School C

This was an urban Senior Secondary school in which there was only one group of students doing Geography at higher grade together with Mathematics at higher grade. The lady teacher handling Geography in this group was inexperienced as she claimed to be in her first year of teaching Standard 10. The school had limited boarding facilities with the result that the majority of students were day scholars. The curriculum of the school allowed greater choice and Geography was a compulsory subject only for the Mathematics and Physical Science group. The class size in this group was in the ratio 1:31. The school was well-staffed and the school enrolment was plus minus 1000.

#### 4.3.4.3 Logistics and ethics.

During the consultations with the Principals of the three schools and Standard 10 Geography teachers, the following aspects of the study were discussed :-

- The nature of the research.
- The researcher's expectation of teachers e.g. that they would be observed during normal teaching.

- There was freedom not to participate or withdraw from the research.
- Teachers and learners were assured of anonymity.
- Suitable dates and times for lesson observation.

It was explained that the presence of the researcher, writing field recordings and doing tape recordings was purely for research purposes with no intention of judgment or evaluation, or of inspecting the teaching performance.

#### 4.3.5 The lessons for observation.

According to the original plan, a total of nine schools and eighteen teachers would form part of this research. Due to problems created by time constraints, the number of schools and classes had to be reduced. The subject chosen for observation was Geography particularly map reading and interpretation and aerial photography analysis. Map studies and photographic calculations were divided into several lessons. It was expected that there would be two teachers per school. The inclusion of the third sample, School C, was necessitated by the fact that in School A only one teacher was responsible for Standard 10 Geography.

Another reason for the inclusion of School C was the withdrawal of the third teacher in School B from participation in this observation process. The grounds for such withdrawal were not satisfactorily determined. Though a Geography teacher, she deliberately allowed her students to be used by another teacher in making preparations for the observation of her Home Economics and Needlework lessons by an inspector. When the Home Economics and

Needlework teacher was requested by the researcher to release the Geography students, she agreed. The researcher came to the conclusion that the Geography teacher did not want to co-operate and as such was abandoned. The teacher from School C had to take her place.

Each teacher was to teach five lessons per week (one per day) which would be observed over a period of five weeks. This observation of one lesson per day gave the researcher an opportunity to review and analyse the data.

#### 4.3.6 The preliminary trial.

In order to detect any problems that could be experienced during the actual research period, the proposed procedures were subjected to a trial. The basic purpose of this pilot study was to determine how the design of the subsequent study could be improved, and to identify flaws in the instruments to be used.

The number of the participants in the pilot study or group is normally smaller than the number scheduled to take part in the subsequent study. Borg et al. (1983:100) gives the following purposes of a pilot study :

- It permits a preliminary testing of the hypotheses, that leads to testing more precise hypotheses in the main study.
- It often provides the research worker with ideas, approaches and clues not foreseen prior to the pilot study.
- It permits a thorough check of the planned statistical and analytical

procedures thus allowing an appraisal of their adequacy in treating the data.

- It greatly reduces the number of treatment errors because unforeseen problems revealed in the pilot study may be overcome in redesigning the main study.
- It may save the research worker major expenditures of time and money on a research project that will yield less than expected results.
- In many pilot studies it is possible to get feedback from research, subjects and other persons involved, that leads to important improvements in the main study.
- In the pilot study, the research worker may try out a number of alternative measures and then select those that produce the best results for the main study.

Travers (1967:82) points out the significance of the preliminary exploration of the problem.

He states that it demonstrates

- whether it is practical to undertake that research.
- whether the available techniques are sufficiently sensitive to measure difference that it is desired to measure.
- whether one can obtain the necessary co-operation of others involved in the study.
- whether there are indications of the subject and other needed materials.

The researcher undertook the preliminary trial of the research measures and techniques. The purpose of this experimental trial was specifically to check the functioning of the sound tape

and the feasibility of recording, the observation schedule, and making field recording simultaneously while observing and listening to the teacher-pupil interaction.

The first day on School A was spent on this preliminary trial. Two periods of 40 minutes each were used on topics of the teacher's choice irrespective of whether they were part of the research project or not. This freedom of choice was granted to the teacher in order to lessen the effect of the observer on the observed and to avoid interfering with the teacher's programme of work.

#### 4.3.7 The variables for observation.

The following variables are based on the theoretical framework developed in the literature of Tharp and Gallimore (1988) and David Perkins (1992). In the analysis of literature in Chapter 2, it was realised that there are links and relationships between the Perkins' (1992) minimum conditions for learning and the Tharp and Gallimore's (1988) six means of assisting performance in a learning ZPD. This relationship contributed to a broader development of variables which needed to be observed in this study. For purposes of emphasis and relevance, the variables have been divided into major and other variables.

##### 4.3.7.1. Major variables.

#### **Clear information**

In the presentation of clear information, the teacher is expected to make use of the following means of assisting performance :

(i) Modeling

(a) The teacher presents information clearly by :-

- demonstrating clarity of purpose.
- presenting of clear and unambiguous descriptions.
- using various forms of example.
- showing the learners how to use information.

(b) The teacher demonstrates desired behaviour by :-

- acting out the desired behaviour.
- verbally describing the desired behaviour.
- presenting clear information.

(c) The teacher assists learner performance by :-

- demonstrating thorough knowledge of the subject.
- demonstrating accuracy in problem solving.
- modeling positive behaviour.

(ii) Instructing.

(a) The teacher sets standards of performance by :-

- telling learners relevant facts and information.
- controlling learners' behavior in class.
- calling learners to attention and readiness for learning.

(b) The teacher assists learner performance by :-

- telling learners what to do.

- directing learners to perform a task.

### **Thoughtful practice.**

During thoughtful practice, the teacher involves learners in problem-solving by making use of cognitive structuring. This is one of the means of assisting performance.

Cognitive structuring.

(a) The teacher gives learners an opportunity to take part in problem-solving by :-

- giving them examples to use in understanding information.
- giving them a variety of situations in which to practice their abilities.
- giving them instances in which they can see how they learn.

(b) The teacher assists performance by :-

- providing a structure for the lesson being taught to guide learning and teaching.
- allowing learners to utilize their own cognitive structure.
- providing a framework for sequencing steps involved in problem solving.
- providing structures that make information easily retrievable.

### **Informative feedback.**

(i) Feeding back

This neo-Vygotskian means of assisting performance is concerned with what the learners gain as a result of the teacher's intervention. Perkins' (1992) "informative feedback "

provides the learner with information which answers the questions :

“How am I doing ” and “What do I need to do improve my performance.”

(a) The teacher monitors the performance and progress of the learners by :-

- counselling learners with difficulties.
- assesses the performance of learners by means of tests.
- giving learners self-assessment reviews.

(b) The teacher assists performance by :

- giving learners feedback about the learning.
- correcting their problematic behaviour.
- determining the required standards of performance.

(ii) Questioning

(a) The teacher establishes the conditions for learning by :-

- finding out the learners' performance level for further guidance.
- asking questions that assist learners to progress as they recall facts.

(b) The teacher assists performance by :-

- requiring learner to give their opinion about issues.
- encountering learners to describe things in their own understanding.
- asking learners to connect various perspectives.
- relating learners' "book" understanding of things to real life situations.
- frequently testing the learners' comprehension.
- asking learners thought-provoking questions.



- encouraging learners to ask questions either to the teacher or other learners.

### **Motivation**

During the process of teaching, the teacher is expected to motivate learners. This can be done by making use of contingency management.

Contingency management.

(a) The teacher establishes conditions for learning by :-

- engaging learning in tasks that are rewarding in themselves.
- rewarding learners for academic achievements.

(b) The teacher manipulates the behaviour of learners by :-

- rewarding a desired behaviour.
- punishing an undesirable behaviour.

(c) The teacher assists learners performance by :-

- correcting disruptive behaviour.
- weakening undesirable forms of behaviour.
- reinforcing desirable behaviour.

#### *4.3.7.2 Other variables..*

(i) Teacher-learner interaction.

This variable addresses :-

- the extent to which the teacher guides the interaction between him or herself and the learners.
- the extent to which the learners initiate the interaction.

(ii) Progression.

This variable addresses the extent to which :-

- the teacher assists the learners in the performance of a task.
- the learner reverts to a previously-known way of performing the task.

(iii) Pupil activity.

This variable addresses the extent to which :-

- the learner participates in the lesson.
- the learners participate as individuals, small groups or as an entire class.
- the extent to which learners respond to the teacher's guidance, instruction or questioning.

#### 4.3.8 Difficulties encountered.

The programme of lesson observation had to be re-arranged because of the teachers' stayaway for two days i.e. on the 15 & 16 August 1997. After the two days of the stayaway, it was not clear to the teachers when the next stayaway would be and how long it would take for them to resume their work. Consequently, the intended five weeks of observation was reviewed because of fear of yet another delay in the programme. This resulted in three weeks of

observation instead of five, as planned.

Some difficulties were experienced, during observation and data collection. During lesson presentations, it was difficult for the researcher in the initial stages of observation to operate on all the three methods of collecting data at the same time. Specifically, it was difficult to observe and write everything that occurred in the classroom. The pre-established categories listed in the observation schedule could not be examined according to the order in which they were written and moreover, the schedule did not accommodate the variation of the categories as they occurred during a particular observation. What rendered the observation schedule unnecessary and inadequate was the interconnections and relationship between categories of behaviours to be observed. It was very difficult to examine the behaviour of the teacher and the learners in terms of related categories. Consequently, the observation schedule had to be used as previously understood and known by the researcher and used in conjunction with the field recordings and tape recordings. Although this was partly expected, the researcher was obliged to include the observation schedule as one of the data-collecting methods. This was intended to guarantee the reliability of data by using more than two methods of collecting data.

Moreover, the listed categories of expected behaviours in the observation schedule assisted in the examination of expected variables. Therefore, the observation schedule was an asset with regards to the compilation of expected variables without which the general observation of the classroom teaching and learning would be less successful.

During the review of observed lessons, all the three means of collecting data were used to get a broader understanding of the classroom activities. The tape recorder assisted in the compilation of transcripts of lessons while the field notes embodied comments to be used in data analysis. The observation schedule provided the researcher with categories of items deemed necessary for observation.

#### 4.3.9. The post-lesson interview with teachers.

The idea of teachers being evaluated could not be removed from teachers' minds, despite the earlier assurance. After the lesson presentation, teachers seemed to be interested to know more about their ability and performance as a teacher rather than the ability to assist learners to perform better as they progress from time to time. During the interviews, the discussions focused on the problems experienced by teachers in the teaching and learning of Geography numeracy skills. Some of the problems cited by the teachers were based on the learners' weaknesses while others were directed to the teachers' failures. Those that reflected on the learners' weakness included the following :-

- The students who are not doing Mathematics as one of the Matric subjects have a poor mathematical background.
- There is a negative attitude among non-Mathematical students which originates from the old belief that anything that is mathematical is difficult.
- The non-Mathematical students lack knowledge of basic mathematical operations such as addition, subtraction, multiplication and division.

*Findings*

- The learners find it difficult to convert units from one to another. e.g. kms to metres, cms to mms.
- The learners have a poor background of Mathematics because of the learning gap between the Junior Secondary Phase and the Matric year, since they do not calculate in Standard 8 and 9.
- The learners lack calculating aids such as calculators and instrument boxes.
- The learners are unable to transfer knowledge gained in the classroom to similar problems in the examination.
- The learners do not seem to have any plans to study Geography at higher level.
- The learners' home backgrounds do not provide for a continuous learning process. Parents are unable to assist their children in solving these Geography problems because of their literacy level.

The problems that were based on the teachers' failures included the following :-

- Learners did not understand the purpose of learning calculations as this was not related to life situations and their career path.
- Learners in some instances were to learn Geography without Mathematics in their choice of subjects.
- Teachers did not use local examples in their map studies as there were no field trips.
- Learners were not exposed to other examples of calculations. Their textbook entitled "Working with Maps" was the be-all and the end-all.

- Teachers' workshops and in-service courses were scarce.
- Learners were not supplied with worksheets so as to do exercises independently. Teachers simply gave them exercises to calculate either as classroom work or homework.

#### 4.3.10 Conclusion.

This chapter has shown how data was collected, including the method of selecting the sample. To design an observation research involved several decisions which had to be taken. The decisions were about the subjects of the research and the aspects of the subjects to be studied. These aspects which were the subject of the study are defined in terms of variables. It was the extent to which these variables were observed which would provide data to address the research question. The analysis of the collected data in the form of lessons observed will be made in the following chapter.

## **CHAPTER 5: THE PROCESS OF ANALYSIS INTERPRETATION OF LESSON OBSERVATION.**

### **5.1 INTRODUCTION.**

The purpose of this chapter is to report and discuss data gathered during classroom observation. The interpretation of gathered data bears reference to how teachers make use of the minimum conditions that, according to Perkins (1992), are necessary for learning to take place, and how teachers apply the means of assisting performance advocated by Tharp and Gallimore (1988). The investigation was based on the observed methods used by teachers in lessons where Geography numeracy skills were being taught. A report on how successful the data gathering methods were during the observation of lessons and the problems encountered thereafter will be presented.

It is important to mention that during the process of lesson observation, the researcher was analysing the course of classroom events as they occurred, so that the field recordings not only recorded what happened but also included the preliminary interpretations. Included in these recordings therefore, were comments on certain segments of data. The proceedings of the observed lessons were recorded in a field note-book while the audio-tape recorded the voices of both the teacher and the learners. The tape recordings were later re-visited for purposes of enlarging on what was left out when rough or scanty notes were made during class observation. The recorded data in the audiotape was retrieved by playing the tapes a number of times to ensure accuracy and reliability, and transcribing them. Full lesson transcripts are to be found in Appendix 1.

## 5.2 RESEARCH QUESTION

The research question was :-

Do teachers accommodate the inclusion of conditions of learning in their methods of teaching Geography numeracy skills?

Another research question was :-

Do teachers use means of assisting performance in their teaching activities?

When these questions were examined in the context of the Perkins' (1992) minimum conditions for learning and Tharp and Gallimore's (1988) six means of assisting performance, several variables for observation came to light. During lesson presentation, it was possible for the researcher to observe whether or not the teacher utilized Tharp and Gallimore's (1988) means of assisting during his or her teaching, and whether the teacher established conditions for learning which are directed by Perkins' (1992) Theory One. The variables chosen were intended to examine the teachers' methods in the teaching of numeracy skills against the theoretical frameworks of Perkins (1992) and Tharp and Gallimore (1988).

## 5.3 THE PROCESS OF DATA GATHERING.

### 5.3.1 The lessons observed

As stated in the last chapter, the lessons observed were those in which the Standard 10 Geography numeracy skills were taught. The lessons taught by teachers in the selected schools reflected the current picture of teaching and learning in the schools.



The observed lessons differed widely in terms of width and ranged from simple to difficult topics. Those who were also doing Mathematics as part of their learning programme demonstrated a high ability in these numeracy skills while the opposite was visible in those who were taking non-mathematical subjects.

From observations made it was evident that some lessons had been taught previously, and were being repeated although some teachers pretended that the learners were being taught for the first time. In two instances, where learners demonstrated mapwork on the blackboard, the entire classes responded in the identical manner. For example, in the conversion of centimetres to kilometres, the class asked in chorus form about the origin of a special number such as two which at all times must be used to divide measured centimetres in order to get kilometres. This procedure has become traditional in the teaching of geography numeracy skills. This question was asked as if the lesson was new to them. Although some of the lessons observed formed part of revision of Standard 7 work, even at Standard 10 level some students especially those from the non-mathematical group, still had some difficulty in understanding how to calculate the “old ”problems.

### 5.3.2 Features of classes observed.

The non-mathematical classes were always overcrowded because learners, in their choice of subject in earlier classes, generally assume that this stream was a “soft option” . Such overcrowding caused problems in the appropriate placement of the audio-tape and the seating accommodation of the researcher. Consequently, in school B some rearrangement of seating

and some adjustment had to be made by way of reducing the number of learners in order to accommodate the classroom observation.

Another feature which distinguished the non-mathematical groups was the failure to bring to lessons the instrument boxes, calculators and even rulers which are supplied as part of the book consignment during the beginning of the year. This resulted in some periods starting a little later than expected because the learners had to run around other classes borrowing these materials from others. In all schools visited, the mathematical groups did not have this problem.

The researcher was unable to establish the rationale behind Geography lessons being timetabled either during the midday or towards the end of the day. In school C for instance, all Geography periods were put on the timetable after the second break. When Teacher C was asked about this common feature, a satisfactory answer could not be supplied. However, it was obvious that such late teaching with its accompanying mental fatigue, hunger, and heat could adversely affects the performance of learners on calculations.

During the teaching of the Geography numeracy skills, the learners continued to operate in the traditional manner, by way of mostly listening to teacher and not querying even in cases where a teacher made a mistake. In school B, teacher B1 used a wrong method of calculating and consequently arrived at a wrong answer. He later realised his mistake which the learners did not see. To a large extent, students showed unexpected discipline. Such a show of goodwill

could be presumed to be caused by the arrival of the researcher as a visitor in class who was audio-taping and note-taking. This unusual practice may have contributed to the compliant behaviour of the learners.

### 5.3.3 The characteristics of the teachers observed.

Although Teacher B2 had 3 years of experience in the teaching of Geography and therefore had little experience, Teacher A and Teacher B1 had acquired university knowledge and sufficient amount of specialized training. In her 3 years experience Teacher C was teaching Geography in Standard 10 for the first time and her knowledge of Geography did not go beyond College education. Two teachers, Teacher A and Teacher B1 were also experienced Geography Senior Markers for the Eastern Cape Department of Education.

### 5.3.4 The activity setting.

These activity settings are intended and organized for assisted performance. Part of the analysis of the collected data was to examine whether the lessons were actually activity settings or not. This involved the analysis of who provided the assistance, in what ways were learners assisted, when during the teaching processes were they assisted and why was it necessary to assist them. The observed lessons were seen to be the result of the “recitation script” (Gallimore and Tharp, 1991:175). The expected activity settings in which there would be collaborative activities, goal-directed interactions and joint productive activities could not be detected. Instead, there was prominence of conveyance of knowledge by the teacher with very little assisting of the learners towards the attainment of performance related goals. No attempts by the teachers was

seen to build a support system for the acquisitions of common meanings and goals among learners. Instead the learners demonstrated rote learning as evidenced by their chorus answering of questions. It was against this background that the teaching of Geography numeracy skills were analysed.

### 5.3.5 Problems encountered in data gathered in tape-reviews

#### 5.3.5.1. *Tape-reviews.*

##### 1. The type of recorder/tape

Although the type of recorder looked good and serviceable, it was difficult to discriminate between the voice of the teacher and that of the learner. Consequently, the researcher acquired another different set of tapes and thereby solve the problem. In some cases, the voice of the male teacher seemed to resemble that of a female. This was solved by recording the gender of the teacher on the field notes.

##### 2. Teachers' movement

Sometimes, the teacher moved from one side of the chalkboard to another whilst standing with his back to the tape recorder. The teacher's voice was produced in mumbled words and consequently giving unclear messages. When the voice of the teacher was unclear, the teacher's words were recorded on the field notes.

##### 3. Soft voices of learners

Despite earlier warnings given in connection with this matter, the learners' recorded voices were very soft and it was difficult to distinguish what was said. This situation was further exaggerated by overcrowded classrooms which made it much more difficult to move the tape recorded from one place to another or put in the centre. This caused the teacher to frequently warn the learners to speak a little louder than they were doing.

#### 4.Spasms of noise

When the learners were required to calculate, a lot of noise was experienced which was caused by shifting of desks and learners themselves when they were trying to borrow some materials such as rulers and mapwork books from others. Such a noise disturbed the recording of what was necessary. This problem was brought to the notice of the teacher who instructed them to stop such a behaviour.

#### 5.Silent recording

Silent recording was experienced when listening to tapes. This silent recording occurred either when the teacher was writing on the chalkboard and therefore no talking was taking place. Sometimes, only the hitting of the chalkboard with the chalk was heard during the writing process. During such periods of silence, the tape recorder was turned off until the voice of the teacher was heard again.

Despite various difficulties, the audio-tape was indispensable, because the researcher would not have been able to make written notes fast enough. When there was silent recording, the

field recordings supplemented such pitfalls.

#### 5.3.5.2 *Field-recordings*

The field recordings consisted of written notes in a field note book. These included the following information which was put in summary form :-

- Routine information such as date and time of observation, the class involved and the topic of the lesson. For example :-

Date: 11-08-97

Class: 10B

Time: 11h00-11h35

Lesson: Calculation of magnetic declination

- How the lesson was started. For example :-

T: Our lesson for today is.....

T: Today we are going to deal with.....

- It was also noted, whether prior knowledge was used by means of questions or not.

T: You will know that we have different types of scales. What are they?

Response of learners were also noted e.g. Chorus form of answering question.

- The presentation of the lesson.

The procedures incorporated in the body of the lesson included :-

-demonstration by the teacher on the chalkboard.

-the use of Perkins' four minimum conditions for learning.

- the use of Tharp and Gallimore means of assisting performance
- the teacher's style or the method of teaching, e.g Recitation script with examples or question and answer method.
- classroom management techniques that were used e.g Instructing for behaviour management and warnings such as "Nomfundo, we are waiting for you".

● Conclusion

How each lesson was ended, e.g

- giving class exercises either from the text or written on the chalkboard for the learners to copy.
- giving homework exercises.
- what evaluation techniques were used, e.g oral questions, written questions and observation of learners' application of numeracy skills.

It was time- consuming to reconcile the field recording with the tape-recordings and make transcripts of lessons of three schools. This demanded several replays of tapes before the final transcript of a lesson could be produced. The field-recordings made it much easier to make transcripts of lessons. This was because the researcher could easily recall what happened as the flow of events followed a systematic and a logical sequence.

The items listed in the observation schedule could easily be reconciled with the behaviours reflected in the transcripts of lessons as they were observed in class and as they were deduced from the recorded classroom activities. Although such behaviours did not occur as listed in the

observation schedule, the researcher did not find much difficulty in analysing them. As indicated earlier on, the difficulty in using the observation schedule arose only in as far as identifying the items of observed behaviours in both learners and the teacher whilst the lesson was in progress.

## 5.4 THE METHOD OF DATA ANALYSIS

### 5.4.1 The methods used

There were two methods used to analyse the observed lessons. The first method entailed the recording of behaviours that embodied Perkins's (1992) minimum conditions of learning and the means of assisting performance as advocated by Tharp and Gallimore (1988). These were noted on the transcript of lessons. The involvement of four teachers from three different schools lent the observation and analysis of data to comparison in terms of time and place. The internalized items listed in the observation schedule assisted the researcher in the identification of these behaviours as they occurred from time to time during lesson observation.

It was important to note that the way teachers assisted the learners differed in various ways. For example, when Teacher A provided a cognitive structure for the calculation of the magnetic declination, he presented a listed format of steps that a learner must go through before reaching the answer. Teacher C provided the learners with several methods of calculating which lead to the same answer. Although these methods had minor variations, when analysed deeply, they meant the same thing, e.g. 0.5 is same as  $\frac{1}{2}$ .



The second method of analysing data was the identification of activity settings. The focus was on whether the interaction between the teacher and the learners was characterised by co-operation, a joint effort, goal-directedness and a production of a desired venture. During the classroom research there were three types of activity setting. One, which was frequently observed, was when the teacher interacted co-operatively for a specific goal with the whole class. Secondly, it was only in school C where Teacher C most of the time interacted with the learners in groups, in which peer interaction occurred. The third type of activity setting was noticeable during the researcher's post-lesson interview with the teachers, during which there were discussions and interactions.

#### 5.4.2 Observation during lesson stages.

It was important to observe and examine whether the teacher was actually teaching according to the logical phases of the lesson in order to facilitate the flow of the lesson and progression in the learners' zone of proximal development. The pre-instructional phase included the verification of whether the teacher was actually teaching one of the proposed topics which had been selected for this study or her own choice.

During the interaction phase, the teachers were presenting information. It was during this phase when there was use of questioning, assisting when there was failure to understand and providing opportunity for practice. The last phase, the post-instructional phase, was characterised by the checking for understanding, provision of feedback, praising and criticizing, testing and homework-giving. It was important to note that teachers differed in their

timing and development of these phases. Some lessons had very long and time-consuming introductions. For example, Teacher A took a very long time teaching different types of scales whereas the main focus of the lesson was the calculation of the area of a map.

This timing of phases of the lesson involves prior planning and preparation. It was clear that two teachers (Teacher B2 and C) did not have much time to prepare their lessons. This became evident in the manner in which they provided feedback to the learners. Class exercises given by Teacher B2 were not equivalent to the Standard 10 work whereas Teacher C gave an exercise which could not be successfully calculated either by her or the learners. The other two teachers (Teacher A and B1) demonstrated that they had done a significant amount of lesson preparation, as evidenced by the illustrations, presentation and informative feedback to their learners.

#### 5.4.3 Materials used during teaching.

Each lesson presented was observed and analysed also in terms of the inclusion of audio-visual aids. The main teaching aids used by teachers were the chalkboard, maps, photographs, demonstrations or diagrams and mapwork books. These could only be used in the classrooms. That does not mean that the teachers could not use field trips in order to combine what is theorized in the book with the real world but none did this.

What was common among the teachers was the frequent use of the chalkboard because:

- it records thoughts as the lesson progresses.

- it allows teachers to make quick sketches.
- it assists the teachers to gain learners' attention.
- it has enough space for the demonstrations and examples.

It was noticeable that it was not the sole prerogative of the teachers to demonstrate how certain calculations were done. There were certain moments when learners were afforded an opportunity to demonstrate and calculate on the chalkboard, while others were either listening or asking questions where they did not understand. Some questions were rhetorical. For example, it was evident in school A on the 11-08-97 in class 10B that when the learners asked the demonstrating learner where she got six, they already knew the answer as they had been taught to multiply by six instead of sixty.

#### 5.4.4 The methods used by teachers.

Bearing in mind that there is no single correct method of teaching a class, the teachers used several methods not only within a single lesson but also from one lesson to another. Among the variety of factors that usually determine the choice of a method to be used in class, there are the ability level of the class, the aims and objectives of the lesson and the context or activity setting intends to assisted the performance of learners.

The lecture method.

It was evident in the analysis of transcripts that the "lecture or telling method" occupied a place of prominence during the presentation of lessons. The telling or lecture method is a method of

teaching which is based on didactics, the part-discipline of the South African philosophy of education called Fundamental Pedagogics. According to this method, the teacher as an adult is familiar with his or her task and knows answers to all questions asked. That is why the teacher tells the learners what to do and how to do it. This implies that during the lesson, the teacher does most of the talking while learners are obedient and passive listeners. The teachers relied heavily on this method because it is the only method that can be used to :

- tell the learners what they have to know.
- tell them how to tackle the problems to be calculated.
- explain fundamental concepts necessary for further learning.
- give direction and steps for comprehending relationships between geographical phenomena.

The teachers also prefer this method because it is a method which is faster in syllabus coverage, and through which their expertise and mastery of the subject can be demonstrated. This demonstration of expertise became evident in instances such as when Teacher A decided to explain the whole concept of a gradient rather than cause the learners to understand it through the manipulation of the vertical distance and the horizontal distance of a slope which they already knew from previous classes.

In general, the learners were not expected by teachers to sit down and remain passive during the “telling” because the explanations were always punctuated by questions either based on what was taught at that time or on prior knowledge. The telling or lecture method then caused the teachers to initiate the interaction, the activity setting and the assistance.

The question and answer method.

Of particular significance in this method are questions that assess and those that assist. The indiscriminate use of such questions was evident throughout the transcripts. The most common assessing question among all the four teachers was: "What is the meaning of 1: 50000?". This was because all the maps used in Standard 10 have a scale of 1: 50000. Also common among them was the asking of questions at the beginning of the lesson. These questions usually called for a definition of a certain concept, an identification of a certain feature on a map and the provision of a structure for calculating a certain problem. Basically, these questions were intended to retrieve some previous knowledge from memory and to lay a foundation for the fresh knowledge to be presented. It was important to note that this reproductive questioning, which belongs to the traditional school of memorization of masses of facts, was still featuring during the presentation and at the end of the lesson. It appears the teachers are still not ready to break away from this tradition. Teacher B2 asked several questions which required recall of learned material although the questions were not related to the lesson topic. An example of this was demonstrated in the transcripts of the lesson taught by Teacher B2 at School B on the 01-09-97 :

T: How else do we term the linear scale?

L: Line scale or Bar scale.

T: What about the word scale?

L2: It is a statement or verbal scale.

T: What does 1:50 000 mean?

T: 1cm : 0,5.

T: How do we do the fraction scale? [Instead of how do we write it?]

Such a question could not be related to the conversion of one scale to another. It appeared that as long as the learners could produce in detail what was presented to them, the teacher would consider them good and he would be satisfied.

There was evidence of assisting questions in some transcripts of lessons. For example, Teacher B1 asked questions that led the learners towards understanding the calculating of distance, speed and time:

T: What is the distance from this school to town?

L1: 11 km (distance)

T: How long we can walk to town gives us...

Learners: Time (in chorus form)

T: If we want speed we cancel here and here.

Some transcripts of lessons did not have this type of questioning which was based on local landscape and on facts that were well-known to the learners.

The discussion method.

Only Teacher C engaged her learners in discussion groups during the analysis of lessons. This method proved fruitful as groups used different dimensions to calculate the scale of a photograph. But lack of preparation on the part of the teacher contributed to the failure of the whole exercise. The teacher did not visualize beforehand what more or less the course and the outcome of discussions were going to be. The inability of the teacher to control the situation

when the groups could not come to a solution demonstrated that the teacher did not have a rich background in the subject and was still inexperienced in the teaching of Geography.

In the transcripts of the lesson taught by Teacher C at school C on the 08-09-97 the teacher was unable to answer relevant questions satisfactorily:

L1: But the answer we get in our group is 476190,3.

L2: Do you put a comma anywhere you like, Mam?

T: No, you don't do that (The teacher did not suggest what could be done).

L3: In the examination, how can this be asked?

T: Don't worry about that. We will come later to that.

This demonstrated how the discussion method could only assist in the process of learning if properly managed.

The project method.

This method was not observed. One possible reason for it not being used is the fact that the time-table of the selected schools did not accommodate an open time necessary for this method. Another factor to be considered is that the schools selected for this study had a conventional type of buildings and not the open plan school where it would be easy to engage learners in a project.

## 5.5 ANALYSIS OF DATA.

### 5.5.1 General observations.

These refer to observations that were part of classroom activity but not related to the

researcher's framework for observation. However, some of these observations revealed interesting insights.

#### Group work.

All the teachers involved in this study valued a one-way interaction in which the teacher stood in front of the class and did most of the talking. It was only teacher C who divided learners into groups in all her lessons. This kind of activity setting is coupled with social interaction, collaboration with others and intersubjectivity between group members. These characterize the Vygotskian model of teaching and learning.

#### Teaching aids.

A variety of maps and photographs was sadly lacking in all the schools observed. The teachers relied on the mapwork book entitled "Working with maps". Learners were, therefore, not exposed to the maps and photographs of different sizes. There was no evidence of the presence of other teaching aids, such as stereoscope, or a set of mathematical instruments such as the protractor, a meter stick, a compass and dividers.

#### Use of children's experience.

Only Teacher B1 used the children's experiences, when he was about to teach problems involving time, distance and speed. For example, he asked "What is the distance from this school to town?" By asking this question, he was actually tapping the knowledge they usually acquire from either home or outside home. All other teachers based their teaching on what was



in the text without reference to the real world.

The classroom environment.

Each classroom was arranged in a standard layout, with desks and chairs arranged in rows. The well ordered classrooms were clean with no litter or pieces of paper on the floor, stray pens or displays on the walls. The non-availability of displays on the walls signified strict reliance on textbooks and limited use of maps.

Lesson plans

None of the teachers who formed part of this study used any lesson notes or preparation books. One reason for this might be that the teachers had prepared their lessons thoroughly \_or that because of their experience they were competent enough to handle the given topic without bringing notes to class.

Aims and objectives of the lesson.

It was only Teacher B1 who, right from the beginning, stated the aim of teaching his class. For example he stated that, “By the end of the lesson you will be knowing the scale conversion”. Other teachers did not feel it necessary to tell the learners his or her aims of teaching a particular lesson. Most of the teaching was begun with :

“Our topic for today is ... ”

“Today we are going to deal with...”“

“Write this heading on your books.”“

“ Our lesson is on ...”

#### Discipline.

Generally speaking, learners in all the classes involved in this study were well behaved and teachers did not have problems of deviating from their planned work because of unbecoming behaviour. It was only during the period when the learners were calculating on their own that the level of noise was raised and the teachers had to caution learners here and there. Even when the noise was pronounced, learners were cautioned politely. For example, Teacher A was worthy of note in this regard: \_

“Well everybody, be attentive”.

“Have you finished Nontsundu ? ”

“Pengwa, we are waiting on you ”.

#### 5.5.2 Specific observations.

The specific observations refer to the analysis of transcripts of lessons in terms of the methods used by teachers in an attempt to assist learners acquire Geography numeracy skills. The methods were analyzed against the background of Perkins` (1992) minimum conditions for learning and against Tharp and Gallimore`s (1988) means of assisting performance in the learners` ZPDs. After a thorough scrutiny of the transcribed lessons and fieldnotes, variables of behaviours that were compatible with the methods of teaching and based on the researchers` theoretical framework were noted and delineated.

It is important to note that the means of assisting performance were also accompanied by other forms interaction such as explaining. Since the aim of the investigation was not discussed with the teachers, their input was not necessary except their views during the post-lesson interviews. The observations were analysed in terms of the following table which contains three expected forms of teaching namely, the recitation script or traditional teaching and non-mediational or meaningful teaching and Vygotskian or mediational form of teaching.

It was abundantly clear that the lessons observed fell in the category of the recitation script.

TABLE 3 : Modes of teaching.

Perkins' Theory One	Recitation Script/ Traditional Teaching	Non-Vygotskian and Non-Mediational/ Meaningful Teaching	Vygotskian/ Mediational Teaching
<u>1. Clear information.</u>			
(i) Presentation	Information-giving, Assistance-giving, Directing of thoughts.	Content presented in logical units.	Use of everyday concepts.
(ii) Explaining	Explaining for the transmission of knowledge.	Explaining limited to linkage between old and new knowledge.	Explaining for assisting performance in the ZPD. Creation of social contexts & activity settings.

(iii) Instruction	Teacher responsible for behaviour and discipline.	Instructing for gaining attention; self-discipline expected.	No discipline problem because of collaboration, co-operation and mutual understanding between teacher and learner.
(iv) Modeling	Evidenced by the faultless reproduction of memorized material.	Limited modeling of demonstrations.	Evidence of modeling.  Internalization of learned material.
<u>2. Thoughtful practice.</u>			
(i) Problem solving situations.	Exercises given based on memorization of rules.	Exercises requiring cognitive learning strategies.	Evidence of problem-solving situations. A cognitive stimulation.
(ii) Meta-cognition	Following of routine steps or methods. No application of metacognition.	Use of metacognitive strategies such as memory aids.	Teaching of metacognitive strategies. Learners should be taught thinking skills to be modeled.

(iii) Cognitive structuring.			
Type One:  Structure for  explanation	Methods used in the  structures for  explanation include  :telling method,  lecture method, drill  method and rote  practices.	Evidence of  structuring of  knowledge into:  hierarchical forms,  headings and  subheading.	Transfer of  knowledge and skills.
Type Two:	Exercises given for  recall and memory  activation and for  application.	Provision of  structures for  memory in the form  of formulae,  information networks  and mind-maps.	Provision of a  holistic approach but  treatment of content  in units.
3. Informative feedback.			
(i) Provision	Responding to  teacher's oral  questions and  instructions.	To discover strengths  and weaknesses of  learners.	Feedback used to  students' independent  performance in  collaborative activity.

(ii) Questioning	Reproductive or assessment questions asked to evaluate the level of knowledge of learners. No assisting questions.	Questioning used is productive questioning that involves application of existing knowledge.	Use of assistance and assessment questions.
<u>4.Motivation</u>	No attempt to motivate learners; contingency management lacking.	Contingency management used for general classroom order and not for motivation.	Motivation of learners. Interactive teaching to encourage learners to develop their own strategies for learning.  Contingency management used for motivation.

It was evident in the observed lessons that transmission was the dominant mode of teaching which amongst other things advocates passive learners, rote learning, content-based learning material, text books, and teacher- led drills. Such a transmission view of teaching belongs to the traditional school in which the teacher is seen as a person who, by means of lecturing or giving of written work, provides the learner with factual knowledge and skills. During the transmission of information, the child is not allowed to take an active part in the teaching-

learning situation. He or she is expected to be quiet, orderly and submissive, reacting only to orders and instructions from the teacher. The learner must listen to the teacher who is the only source of information. He or she must observe the teacher's demonstrations and follow the directions given to him or her.

#### *5.5.2.1 Presentation of lessons.*

The presentation of the lesson was realized to consist of three types namely, information-giving, assistance-giving and directing of the learner's thoughts.

- **Information- giving**

All teachers whose lessons were observed used the telling method to impart knowledge and skills. The typical interaction in the classroom was one in which the teacher did most of the talking, while the learners responded to questions after which the teacher passed a comment or a remark. During the information-giving process, the learners sat silently and listened to the teacher who was viewed as an expert. Teacher A in school A (on 18-08-97) could not progress with the teaching of the gradient in slopes without telling the learners what the gradient was, what its value was and how it was calculated.

That the teacher is expected by the learners to know all solutions to all problems was evident on numerous occasions during lesson observations. It was easy for the learners to offer no response whenever the teacher wanted to find out whether or not they knew a certain concept, because they wanted spoon-feeding because they wanted to be given the correct answers by the teacher all the time. An example of this spoon-feeding was observed from a lesson taught

by Teacher A in school A (18-08-97) :

T: What does gradient tell us about? Nomfundo.

L1: (no response from Nomfundo )

T: Can you try Mziwonke?

L2: No response from Mziwonke.

T: The gradient tells.....

T: The gradient tells us about the average steepness of a slope.

Another example which demonstrated the “empty-vessels” attitude of the learners was observed from a lesson by Teacher B1 at school B (25-08-97).

T:[Teacher drew a rectangular diagram which represented a map. A line was drawn between point A and point B and a scale of 1:50000 was on it ] What does this mean?

[When the learners did not respond to the question, the teacher answered it himself.] It means 1 cm is 50 000cm.

### ● Assistance-giving

The presentation of lessons was also coupled with assistance which was given to the learners especially when and where they failed to comprehend certain aspects of the content. This assistance was characterized by the repetition of explanations by the teacher without modifying them. The assistance given was in some cases not requested by the learners, but the teacher took the initiative. This repeated assistance was observed in the lesson taught by Teacher A in



school A (11-08-97) :

T: If the magnetic declination in 1981 was 20,3 degrees, and when you change this to minutes, what is your answer?

L1: 20 degrees 18 minutes.

T: Therefore, the magnetic declination in 1981 was 20 degrees 18 minutes. Do you understand this Nomfundo?

L: No.

T: [Teacher gives the same explanation of converting the fraction of degrees to minutes] .

### ● **Directing of thoughts**

The basic idea of an introduction is that the learners thoughts should be directed towards the presentation that is to follow. During the lesson observations, teachers demonstrated their ability to introduce a lesson in such a way as to capture the interest and attention of the learners. The selection of particular topics for a lesson already implied a carefully planned material for learning. The presentation of lessons was not characterized by general information-giving but was guided by the directing of learners' thoughts to particular topics and important aspects of the learning material. Each of the teachers involved in the study emphasized the importance of converting centimeters to kilometers although they used different methods. Teacher A actually told the learners that,  $100\,000\text{cm} = 100\text{m}$  and  $100\text{m} = 1\text{km}$ . This showed that the teacher was intending to drill the learners into learning the sequence or the table by heart with a view to transcribe it at a later stage verbatim.

Teacher B1 directed that the centimeters are divided by two to get kilometers e.g 20cm:10km. Teacher C maintained that in order to get kilometers from measured centimeters, one must multiply the given centimeters by 0,5. It was important to note that this operation functionally formed the basis of several mapwork calculations.

#### *5.5.2.2 Explaining*

During the development of the lessons, teachers were frequently observed to be demonstrating clarity of explanation. Such explanations were viewed as showing connections and relationships between facts, concepts and meanings. As learning material was presented step-by-step, explanations were often punctuated by examples in an attempt to help the learners to comprehend the new concepts. This required not only large amounts of verbal explanations but also teacher-student interactions which included questions and answers and the correction of errors.

Teacher A gave an elaborate explanation and a simplified version of the gradient based on the learners' personal experience which was presented on 18-08-97 :

T: The gradient is the relationship between

(i) how high you have climbed.

(ii) how far you have walked on the horizontal surface.

Right, look at this diagram. If the vertical distance is 100m, then this means fifty over hundred which is equal to two which is the vertical distance over horizontal distance.

1 is to 2 means that for every 2 metres you move horizontally, you climb by 1 metre.

Here is an example :

If on a map with a scale of 1 : 50 000 there is a spotlight which is 150m and a trigonometric beacon number 88 with the height of 200m, calculate the gradient.

Remember, 2cm is equal to 1 kilometer which is equal to 1000 meters. All right. Before you go to this exercise, let me give an example where the gradient between two points is vertical interval, which is 50 meters and the measured distance between the same points is 4cm. The gradient will be 1:40. Now calculate this :

50m/3cm.

What is the correct answer ?

L1: 1:30

Teacher C in the lesson on the 08-09-97 explained the three methods of calculating kilometers from measured centimeters. Although the teacher was able to demonstrate by way of examples how the methods were used, she could not explain why one had to multiply the measured distance by 50 000 and divide by 100 000; nor why one had to divide the measured distance by 2 and why one had to multiply it by 1/2.

#### 5.5.2.3. *Instructing*

This is a means of assisting performance teachers used for behaviour management, setting of expected standards of performance and preparation for information-giving. In order to accomplish these objectives learners were told what to do and what not to do. There were three types of instructions that became evident during the lesson observation which are discussed hereunder :-

- **Behaviour management**

Teachers consider it essential to maintain order, discipline and control in their interaction with learners in the classroom. They want their learners to be well-prepared and organized for the learning of new learning material. In some instances classroom noise was ignored by the teacher although this relaxation of the rule resulted in a more increased volume of noise. This occurred during the lesson presentation of the 14-08-97, when Teacher A was having a look at his text and paging here and there, and on 08-09-97. When Teacher C failed to come up with the correct answer until she abandoned the exercises:

T: In your groups measure any two points on the map and see whether you get the same answer. Let's forget about the previous example.

During the lesson observation on 18-08-97, Teacher A was concerned about the disruptive behaviour of some students. First, he gave an instruction that the learners should write a lesson topic in their books. Such an instruction was ignored by some students (Nontsundu and Pengwa) who were noted. This episode occurred in this way:

T: Write this heading first. [That referred to the lesson topic: Aerial photographs.] Have you finished Nontsundu. Phengwa, we are waiting on you...

Generally speaking, there were few instances that required the utilization of behaviour management. This kind of unusual state of affairs could be attributed to the pretence of students as a result of the presence of the researcher in class.

- **Setting of expected standards of performance**

The teachers generally teach their learners to reach a certain desired level of attainment and so set the standard for higher achievements. This is usually evident when the teacher warns the learners about the importance of certain aspects of their work.

When presenting a lesson on 14-08-97, Teacher A summarized it as follows:-

T: Bear in mind that when you use the ratio scale the answer will be in square kilometers. Also bear in mind that you simply divide by two to get kilometers .

The lesson on the 18-08-97 had this warning from teacher A.

T: Always remember these: One centimeter is equal to five kilometers which is equal to five hundred metres.

- **Preparation for information- giving**

Teachers give instructional commands in order to set the learners thinking in a particular direction. This is done by fixing the learners' attention on the theme and purpose of the lesson. The teachers lead the learners to start thinking along the lines that the lesson would follow, so that they (theoretically) will be able to participate meaningfully when they are given the lesson.

Although there were so many instructions given at the same time by Teacher C in school C, a preparation for information-giving and for the beginning of the lesson could be discerned (08-09-97) :-

T: OK. Let's be ready. Form up your groups. Our lesson is on

distance.[“distance”written on the chalkboard ]. The distance will be measured on the map in centimetres and converted to kilometers and meters. Take out your mapwork books and turn to page 34. Find the distance between Trig. Beacon number 8 and the railway line. If you have got your distance tell me.

Each of the teachers in this investigation either attracted the attention of the learners by writing the topic of the lesson on the chalkboard or by instructing them to turn to a particular page in their mapbooks. In that way, the learners` attention and interest were kept within a desired cognitive frame of reference and prevented from wandering.

#### *5.5.2.4 Modeling*

In terms of the requirements of the traditional school, the teacher`s task is to become an expert in presenting the content of the subject matter. Modeling occurs when learners imitate the teacher`s style of dispensing information. The accomplishment of this means of assistance eventuates in memorization of facts, rote learning through drill and reproduction of memorized material.

Teachers A and B1 employed the drill method in which there was routine repetition of facts for the establishment of habits. It was common to listen to the learners giving yes/no answers in chorus form . The lessons of Teacher A and B1 demonstrated the features of the recitation script.

Teacher A :11-08-97

T: How do you identify mountains?

Learners (in chorus form) : Contour lines.

T: Is that OK. ?

Learners (in chorus form ) : Yes.

T: Any problems here ?

Learners (in chorus form) : No

Teacher B1 on the 25-08-97 repeated the facts himself while some learners were listening and others were copying the chalkboard summary.

T: Now we are left with this question

$$S = d / t$$

What must we do now? First change 20 minutes to hours, like this:

$$20/60 = 0,333333... \text{ hr, therefore the speed is } 6,5\text{km}/0,333333.$$

Secondly divide this using your calculator. What is your answer?

Learners ( in chorus form ) : 19,7 per hour.

An example of an habitual calculation for which the learner could not account was observed in the lesson of teacher A in which other learners were querrying the calculation by six in order to get minutes from a fractional degree (11-08-97).

This habitual calculation resulted in the incorrect mathematical operation where  $0,5 \times 6 = 30$  instead of 3.

T: The answer is 18 degrees 30 minutes. L: How did you get this?

Please come and show us on the chalkboard.

L1: Multiply 0.5 by 6 to make 18 degrees 30 minutes.

Learners : Where do you get six?

L1: It's actually there .

Learners (in chorus form) : Where?

L1: The teacher said so.

#### 5.5.2.5. *Thoughtful practice*

This involves the application of knowledge in a wide range of problems.

- **Problem -solving situations.**

The construct of thoughtful practice was characterized by the giving of exercises to be calculated in class and as part of homework. This in-class calculation occurred after demonstration by the teacher. In some cases, some learners were selected to demonstrate on the chalkboard how certain calculations were done while others were checking the accuracy and the correctness of the answers. It was important to note that the exercises given by the teacher were taken from well-prepared examples of the mapwork book, "Working with maps".

The lesson presented by teacher B1 on 25-08-97 bears testimony to this assertion:

T: Now, I want someone to come to the chalkboard and calculate this exercise. If a train travels at 48 km/h, how will this journey last in minutes if the distance is 6,5 km. [One learner volunteered and demonstrated on the chalkboard while others were watching.

To get the correct answer she used her own calculator ].

The exercises given were selected in such a way that they had to fit the rules previously taught. For example, in most of the observed lessons there was frequent use of the following procedures :



- Divide the measured centimetres to get kilometres.
- Multiply the calculated kilometres by 1000 to get metres.
- Multiply centimetres by  $1/2$  to get kilometres.

### ● **Metacognition**

By definition, metacognition refers to mental process that assist learners to reflect on their thinking by internalizing, understanding and recalling the content to be learned.(Borich 1996:388). They include thinking skills such as self-checking, self-monitoring and analysing as well as memory aids (called mnemonics) for classifying and recalling content (ibid: 388). For learners to analyse their own thinking, they must be shown the reasoning involved in the process of solving a problem rather than having demonstrated to them how a particular problem is solved.

The traditional method of teaching does not make use of metacognition as a strategy for self-directed learning. Instead, the teacher gives the learners the mechanics of solving problems by instructing the learner to follow the routine steps or method. During this demonstration of steps, the learner follows the directions without inquiry or query. This ends up in the mechanical memorization of steps or rules to solve routine problems.

Teacher C of school C in her lesson of the 08-09-97 gave learners three methods of calculating kilometres instead of making the learners conscious of the reasoning involved, and demonstrating the mental procedures that are involved in the routine completion of the problem

at hand. Such methods were presented as follows :

T : How do we calculate kilometres ?

L : We multiply 5,7cm by 10 000.

T : I don't think that is correct. There are three methods of calculating kilometres. Look at these methods. In the first method, you multiply your measured distance by 50 000 and divide by 100 000.

For example :

$$(5,7 \times 50\,000)/100\,000 = 2,8\text{km [Demonstrated by the teacher]}$$

In the second method, you divide your measured distance by 2. For example :

$$5,7 \times 1/2 = 2,85\text{km [demonstrated by the teacher]}$$

In the third method, you multiply your measured distance by 1/2 or 0.5. For example,

$$(i) \ 5,7 \times 1/2 = 2,85\text{km [demonstrated by the teacher].}$$

$$(ii) \ 5,7 \times 0,5 = 2,85\text{km [demonstrated by the teacher].}$$

#### 5.5.2.6. Cognitive structuring.

Type I cognitive structures include structures for explanation. The traditional methods of teaching that were used for explanation during the observed lesson were the telling method, the drill method and other rote practices. Coupled with these methods were sequences of steps involved in the solution of a problem or a calculation of an exercise.

The steps to calculate the magnetic declination were listed by Teacher A

during the lesson presentation of the 11-08-97.

T: (1) Present year or year for which you are calculating or have been asked to eg. 1985

(2) Map date of the magnetic declination eg. 1981

(3) Difference in years = (1) - (2)

(4) Annual change examples = 2' (minutes)

(5) Annual change multiplied by difference in years.

(6) Direction of change = east (therefore subtract)

(7) Subtract total change = 20 degrees 18 minutes

(1981) ...?? (M..d..for years in one)

In Type II cognitive structures, learners may be assisted by the provision of structures for memorizing the content of the subject matter or the rules of explaining or solving certain problems. It was important to note that the exercises given by the teachers in the observed lessons included reflecting, recall and application. Recall was observed when learners stated specific facts or gave information in much the same form as it was previously presented by the teacher. This was evident during Teacher B1 and C when the learners reproduced the formulae for calculating some problems. During Teacher B1's lesson (28-08-97), the learners were able to recall the formula that is used with problems that involve distance, time and speed. The formula which is in the form of an equation is:-

Distance = Time x Speed

During Teacher C's lesson (08-09-97), the formula that was recalled was that for finding the

scale of a photograph. The formula is :-

$$\text{Scale} = (\text{Photo Distance} \times \text{Map Scale}) / \text{Map Distance}$$

It was commendable to see how the learners were encouraged to apply the information they had learned in order to reach an answer to a problem. The application questions required learners to apply rules to a problem in order to determine the correct answer. Each demonstration of problems-solving was followed by an exercise in which learners applied the rules of computing in different units and numbers. This was remarkable in all lessons observed.

#### *5.5.2.7. Informative feedback.*

- **Provision of feedback**

Feedback implies specifically the information obtained by the teacher after the performance and progress of the learners have been assessed through the various methods. During the observation of lessons of the teacher feedback was provided after written exercises, and demonstrations of problem-solution were carried out. Most of the questions asked by the teachers were oral and therefore needed immediate response. It was in the answering of such questions that the chorus form of responding became a feature whose roots were in the traditional school.

- **Questioning**

It was important to note that the teachers during lesson presentations asked questions of different natures. These included the following :-

## (i) Assessing questions

Most questions of this type were observed in the lesson presentation by teacher B2 on 01-09-97.

T : What is a map?

Learners : (no response)

T : A reduced representation of reality. What is a scale?

Learners [No response]

T : A degree of reduction. What are different types of scales?

Learners : [Different types of scales were given by the learners such as ratio, linear, fraction and word scale.]

Although some questions were not answered, the teacher was expecting the reproduction of definitions of such concepts. Such questions belong to the traditional school in which learners are required to remember isolated fragments of information which they cannot relate to their lives or their gained knowledge. As long as they could reproduce verbatim what was presented to them, the teacher would be satisfied. That is why Teacher B2 found it frustrating when learners did not respond to his questions :

T:What's wrong with you? Why are you not answering my questions?

Is it because there is a visitor in our class? Please respond.

## (ii) Assisting questions

These questions were intended for the application of rules and principles. They were determined to assist the learner to arrive at the correct answer. Such questions are necessary

as they offer a challenge to the learner as he or she is being prepared for independent solving of problems. The exercises, which every teacher involved in the study gave to the learners after a demonstration, fell in the category of assisting questions.

Although the following questions belong to a cognitive rather than a sociocultural approach, it is important to make note of them as they were used by the teachers in the lesson presentation.

### (iii) Explanatory - type questions

These questions were used to identify reasons for specific occurrences. Teacher B1 made use of this type of question during the lesson presentation of the 25-28-97 :-

T: How do we convert this to kilometers?

L: We divide by 100 000cm

T: Why?

L: We change centimeters to kilometers.

T: What is this 50 000/100 000.

Learners: ( in chorus form ) : Half of a kilometre.

T: How do we convert  $\frac{1}{2}$  to a decimal?

L: 0.5km.

T: If the distance on the map is 20cm, what is the actual distance?

L: 10 km.

T: How do you arrive at that?

L: Divide twenty by two.

T: Why?

(iv) Non-questions.

This is, by implication, asking but is not put in question form. Teacher A was observed to be using this type of question during the lesson presentation of the

11-18-97 :-

T: What is the number for number one?

L1: 1985.

T: Yes, No.2?

L2: 1985.

T: No.3?

L3: 4 years.

T: Next?

L4: 2 minutes.

T: No 5?

L5: (2minutes x 4 years ) is equal to 8 years.

T: Change of direction?

L6: East, therefore subtract.

T: The last one?

L7: 20 degrees 18 minutes.

Generally speaking, the questions that were frequently used were either the assessing or recall questions which called for the retrieval of previously learned information. The leading or

assisting questions were seldom used. This demonstrates the perpetuation of the recitation script. It is also worthy of note that in all the lessons observed, except the lessons of Teacher C on the 08-09-97, that there were no pupil-initiated questions. This, too, reflects on the attitude and style of learning that still belongs to the traditional school in which there is no query, nor questioning but to follow the direction given by the teacher.

#### *5.5.2.8. Motivation*

Strong motivation, especially the intrinsic type is recommended as the fourth criterion for effective teaching by Perkins (1992). There was no indication of intrinsic motivation among the learners observed, but the duration of observation was short. To observe teachers using strategies to link intrinsic motivation among learners with relevant learning activity would require a long period of observation.

Teacher A was noted for his style of ignoring an incorrect answer. This occurred during the lesson of the 11-08-97 :-

T: What do you say Nomfundo?

L: White city [As the answer was semi-correct, the teacher decided to ignore it ]

By failing to reinforce the response of the learners, the teacher was indirectly indicating that the given answer was undesirable and therefore incorrect. In this way, the teacher used contingency management instead of telling the learner directly that she gave a wrong answer. As indicated previously, there were no instances of disruptive behaviour which needed



contingency management and instruction. It was also noted that the teachers, generally, did not value the use of rewards such as nods, praises and encouragements even when correct answers were given by the learners.

## 5.6 CONCLUSION

In conclusion, the use of Perkins' (1992) minimum conditions for learning as the main theoretical framework in the analysis of the observed lessons gave the researcher an opportunity of comparing the theory with practice. Although the research was based on the theoretical assumptions of Perkins (1992) and Tharp and Gallimore (1988), it was also the intention of the researcher to examine how far the teachers had moved from the traditional school to the mediational form of teaching.

The findings of this investigation will, therefore, be derived from the analysis and interpretation of the observations. Conclusions and inferences will be made, based on the result of the lessons observed. This will be the purpose of the next chapter.

## **CHAPTER 6. CONCLUSIONS: MAJOR FINDINGS AND IMPLICATIONS, LIMITATIONS AND RECOMMENDATIONS FOR FURTHER RESEARCH**

### **6.1 INTRODUCTION**

In the literature review, the place of knowledge was described as a major factor which underpins competence and performance. It was from the typology of knowledge as declarative, procedural and conditional that a distinction between knowledge and skills could be identified. ( Driscoll 1994:337). Jessup (1991:121) maintains that “skills can only be demonstrated through the application in the performance (doing something ), while knowledge can be elicited through more abstract means of conversation, questioning and writing.”

It became clear from the study that the learning of both skills and knowledge required powerful theoretical models and methods of teaching. Furthermore, any knowledge that the individual possesses can be inferred from the performance of skills. Complete reliance on a single mode of teaching reduces the activity of learning to a state of routine and boredom.

It was during the lesson observation that certain factors emerged as deterrents to the acquisition of Geography numeracy skills among Standard 10 learners and therefore contributing to a high failure rate. As competence generally is viewed in terms of the ability to practise a skill over a range of context or situations it is possible to detect incompetence and failure among learners. This may be done by relying on performance which demonstrates competence in the application of skills. In a school situation, this assessment

of competence is done practically by means of tests, reviews and examinations.

This chapter presents a summary of the entire study in terms of, aims of the investigation, literature review, and methodology and major findings. Out of this, conclusions are drawn, and limitations and implications are discussed. Furthermore, there are recommendations for further research in this field of investigation.

## 6.2 THE SUMMARY OF SKILLS.

The purpose of this study was to determine whether the methods used by the teachers in teaching of numeracy skills were assisting learners or not in improving their performance. In particular, this study set to investigate :

- whether or not teachers used Perkins' (1992) minimum conditions for learning: clear information, thoughtful practice, informative feedback and motivation.
- whether or not teachers made use of modeling, instructing, cognitive structuring, feeding back, questioning and contingency management.
- whether or not teachers had moved away from the traditional form of teaching which Gallimore and Tharp (1991) term the "recitation script".
- whether or not the teachers made use of non-mediational teaching, meaningful teaching, or Vygotskian mediational teaching.

### 6.3 SUMMARY OF FINDINGS.

#### 6.3.1 Negative contingencies.

One of the remarkable features of the teacher-learner interaction was the failure, on the part of the teachers, to appropriately manage contingencies. Instead of reinforcing learners for desirable responses after questioning and assignment of tasks, teachers merely took their reaction for granted. The expected social reinforcers for motivating learners such as verbal praise, attention or approval were ignored by the teachers. It was not clear whether teachers viewed the Standard 10 learners as older children or adults since previous research has demonstrated that younger children respond more to social reinforcers than older children. In the lessons observed, teachers often failed to reinforce the desirable responses of learners such as the giving of a correct answer, the volunteering to demonstrate calculations on the blackboard and even chorus answering of questions. This lack of reinforcement, reassurance about the success of task performance and feedback about learners' progress demonstrated the teachers' neglect of positive contingencies.

#### 6.3.2 Teacher-directed instruction.

Generally, teachers are regarded by learners as authorities of the subject matter they teach. They are seen to be responsible for the teaching method they choose, for leading the proceedings of the lessons and for rewarding kinds of knowledge that meet with approval. It was realized in the schools involved in this study, learning occurred according to the initiative and desire of the teacher with very little desire for student self-directed learning. This became evident when teachers did most of the talking about the content of the subject

while the learners remained, passive listeners who obeyed the teachers' instructions.

Such an approach is analogous to the approach prior of the seventies in which the child was regarded as “ an empty vessel, ready to receive whatever knowledge the adult would decide to pour into him or her”(Duminy 1976:60). In this way, teaching and learning centred round the teacher and the subject matter or learning material .

### 6.3.3 Lack of pupil-initiated questions

During the observation of lessons, teachers often failed to encourage learners to ask questions in the classroom. During the presentation of the lesson, the teacher gives information and asks most of the questions. This failure of teachers may be attributed to a system of education which is not centred on developing inquiry attitudes and skills of learning- what is commonly described as culture of silence in the classroom. As indicated previously, there was an indiscriminate use of questions by the teachers while the learners answered these questions by giving one or two words. Most of these questions that were asked were intended to assess the level of understanding of learners. Consequently, reproductive questioning dominated in the presentation of lessons, with very few instances where the learners posed questions. During this observation period, it was only in school C where a few students asked Teacher C on 08-09-97 where they did not understand the photograph scale calculation using a formula and how this could be asked in the examination.

The difficulty experienced by teachers in instructing learners to pose questions emanates from the belief that students, by so doing, are challenging the authority of the teacher about the knowledge of the subject. Moreover, teachers have a tendency of refraining from admitting when they do not know the answer to a question as a teacher is expected to know every answer that relates to his or her subject. This was evident during observation of lessons taught by Teacher C in School C. When the teacher gave a wrong answer, she decided to proceed rather than admit the mistake.

#### 6.3.4 Neglect of group work

In the sample of selected schools, only one school (school C) made use of group work during the teaching of Geography numeracy skills. This ensured co-operative learning as students work together in small groups and helped each other. The schools whose lessons were observed still relied mostly on the teachers' presentation of information with very limited pupil-activity and no discussion was entertained. This presentation of information was punctuated by the teachers' modeling of demonstrations and learners' calculation of assigned tasks or exercises.

#### 6.3.5. Overuse of the lecture method

Teaching in the observed classes was generally characterised by a lecture or telling method, a teacher-centred method which originates from a South African didactic philosophy of teaching. Such an approach emphasizes the "recitation script", lecturing, direction-giving, demonstrating and telling the child what to do and what not to do in its operation, the

approach does not encourage verbal interaction between the teacher and the learner as most of the talking comes from the teacher. This was often accompanied by disciplining instruction for the creation of attention among learners.

#### 6.4 IMPLICATIONS OF THE STUDY.

This research has revealed that there is a great need for a review of methods of teaching mapwork skills. Such methods should aim at assisting performance of learners and should not just be used to present information. Moreover, learners should be subjected to continuous evaluation in order to gauge their performance in these skills. As indicated previously, even in Curriculum 2005 the need for assessing the performance of learners will still constitute a significant part of the education process. It is emphasized that in order to meet the assessment criteria for a particular unit of study or skill development, learners will have to be aware of the principles that determine competence and good performance. As suggested by Perkins (1992), counselling and special support will be required by learners who repeatedly fail to meet the specified standards. This has a direct implication for the choice of effective methods of teaching and how learning should be facilitated.

The frequent use of the traditional, telling method in the observed classes reflected on how teachers as learners were taught and on how as teacher-trainees were trained. Teachers were taught by means of this method and they, in turn, teach their learners using the same approach. Such a vicious cycle is bound to remain with the teachers for decades to come as there are very little visible signs of changing this style of teaching. Even the newly trained

teachers are bound to revert to their earlier forms of learning as they do not experience collaborative activity once they join the teaching profession.

Most of the lessons presented by the teachers during this research appeared to have been taught previously. This implied that the time for new lessons was almost over since it was towards the end of the year. Consequently, some teachers were not fully prepared to present the learning material as new, but loaded the learners with series of questions, some of which were left unanswered. In spite of several criticisms and condemnations that are levelled against the utilization of the stimulus-response approach of behaviourism, the recitation script and its forms of assessing still persists in schools. The reason why the recitation script is still the most prevalent mode of teaching which is in use is that it has proved to be a workable alternative in situations that call for performance, evaluation, coverage of work and transmission of masses of information. This is evident in the chorus form of answering questions and the emphasis on the acquisition of textbook-based knowledge. One of the important implications of the study was its emphasis on the development and acquisition of numeracy skills which need to be assessed. In his discussion of the kinds of assessment, Clarke (1997:15) contends that in outcomes-based education, performance will be criterion-referenced and skill-based rather than norm-referenced and content-based.

The literature that was reviewed and tested had one important implication for learners. For quite some time learners will grapple with the learning material without support and



encouragement from the teachers. Teachers will merely teach to cover the set learning programme without assisting and guiding the learners in order to improve their learning and performance. This also implies a disparity between theory and practice of education.

In terms of Gallimore and Tharp's (1991) theory of schooling, the schools fail to organize activity settings for orientation and training like other social organizations. What is emphasized in this theory does not take place. According to this theory, activity settings for teachers should include workshops, training in in-service courses and other coaching programmes in order to improve performance of teachers.

As most teachers prefer to work alone, they remain isolated from one another and therefore lack assistance in the performance of their duties. The reason why there is seldom joint productive activity among teachers is the hierarchial structure of the school staff and the management which emphasizes the directing of subordinates in task performance with no joint participation among both the directors and the subordinates. Gallimore and Tharp (1991:201) sums the implication of this neglect of this collaborative activity: "Without performance assistance for themselves, there is no chance that the teachers will ever learn to assist the performance of their students.

## 6.5 LIMITATIONS OF THE STUDY.

After the review of literature related to this investigation, it was realized that this study was concerned with a wide field which could not be studied in a short space of time. As a result,

only a small part of the Geography content, such as numeracy skills was selected, although, by its mathematical nature, its findings could not be generalized to other aspects of the subject.

Due to the time limits, the selected Geography topics could not be covered in the observed lessons sufficient depth, especially as the year was drawing towards the end. In order to satisfy the demands of the investigation, each topic could only be allocated 35 to 40 minutes after which another one was to follow although on another day.

Another limitation of this study was the fact that the researcher was not only inexperienced in conducting research but is also a product of the South African philosophy of education called the Fundamental Pedagogics which stresses the transmission of knowledge and skills. This limitation coupled with the researcher's subjectivism and bias might have affected the interpretation of the results.

The learners involved in this study were from two different African backgrounds (rural and urban). Learners might have differed in initiative and interaction because of their different cultural and social backgrounds. The learners' differing interactions might have been interpreted differently from the true state of affairs. Moreover, the sample was not fully representative of the South African population of learners and teachers as they both belonged to the Black population. The generalizing of the results of this investigation to

all learners and teachers of the South African population, should be done with great care and caution.

The extraneous variables such as teacher characteristics, the period of lesson observation, the presence of the researcher during lesson presentations, the seriousness of the learners and the lack of Geography calculating material such as instrument boxes may have affected the results of the investigation.

This study is confined to Geography numeracy skills, a section which cannot be taught in the same way as other sections of this subject because it includes calculations and exercises. Moreover, the investigation has not been extended to other subjects of the school curriculum for a more comprehensive pattern of teaching.

Despite the limitations of this research, it is important to note that the results depict a consistent trend when compared with those of other researchers who based their investigations on the same theoretical frameworks. The literature review demonstrates this assertion. Although such results may not be generalized to other samples with confidence, they may be used for the benefit of the population to which the selected samples belong.

## 6.6 RECOMMENDATIONS FOR FURTHER RESEARCH.

This small-scale study has supported other findings that there is very little genuine teaching that occurs in schools. The study of minimum conditions for learning and the analysis of

teaching as assisting performance in the zone of proximal development is not yet fully explored in the South African context. As a result, little local information on the applicability of such theoretical framework is available.

This study attempted to establish the progression in the zone of proximal development and mediational teaching. As already stated previously, actual teaching was dominated by teacher-directed methods and it is in the light of the findings of this research that the following recommendations are made in order to develop more research in the theory and practice of teaching :-

- Research into the ways of utilizing the lecture method of teaching for the benefit of the learners.
- The replication of this study to examine the applicability of Theory One and the means of assisting performance in other learning areas.
- The involvement of larger samples from other schools to accommodate other population groups of South Africa. In this way, results for such a study will be generalized for a wider application.
- The use of other methods of collecting data apart from the ethnographic approach which has limitations of subjectivity, sample size, different observers and observation of part of the picture. Such methods could include systematic observation and Flander's Interactional Analysis Categories (1970).
- Inclusion of teachers as teacher researchers in classroom inquiry because teachers and learners are rich and essential sources of information as they are always present

in the teaching-learning process.

- The research into the feasibility of teaching Geography with computer programmes such as word processing, databases and spreadsheets, geographic information systems and multimedia materials in order to follow the example of the developed World.

#### 6.7 THE CONCLUDING REMARKS.

The need for research on teaching to adopt varied approaches and to document the actual transactions between the teacher and the learners in the classroom is long overdue. Studies in which learners are merely tested at the end of the year and after a new programme of learning are no longer adequate. The teachers should not only concentrate on the business of teaching exclusively but should develop skills of capturing what is happening in the classroom and reflecting upon their own practice.

For purposes of conscientizing researchers and improving observational studies, Carew and Lightfoot (1979:70) mentions three methodological problems that become a drawback in the advancement of such studies. These are :-

First, the lack of a longitudinal perspective.

Secondly, the lack of interest in variation of treatment within the classroom.

Thirdly, the lack of focus on the behaviour and characteristics of children with most of the focus being on the teacher as a target of observation.

One of the most important revelation of this study is the frequent use of the “recitation script ”. For teachers to be competent in handling Curriculum 2005, more in-service workshops should be organized to obviate the perpetuation of this traditional mode of teaching. The analysis of the teacher’s methods, which was the purpose of this research, indicated a non-reliance on one method of teaching.

The use of varied approaches of teaching will not only benefit the learners but will make the work of the teachers more interesting. This suggests a new style of teacher training which must be adopted by Colleges of Education; a style which will not only move away from the old didactic principles of teachings but will prepare them for the new envisaged curriculum framework. Needless to mention that Perkins’ (1992) minimum conditions of learning and the means of assisting performance as advocated by Gallimore and Tharp (1991) could, still in future, by their nature of depicting different settings and contexts, occupy a prominent place in the teaching-learning process. The following remark from Libbe (1995:504) provides a suitable closing of this dissertation : “Using our efforts to enhance Geography will not only result in better education if we continually ask difficult questions about our own teaching, respond with honest answers that are not always flattering, and work to improve our own teaching ”.

Although Vygotsky and his followers such as Tharp and Gallimore (1988) stress teaching through the zone of proximal development, it is evident that the notion of the zone of proximal development portrays certain weaknesses and impracticabilities that render it

unworkable in some classroom situations. Miller (1993:392) observes that there are difficulties of assessing performance in the zone of proximal development. Firstly, although two children may have the “same” level of unassisted performance in a given task, they may differ in how much they are able to learn given similar amounts of teaching. This is because some children have larger zones of proximal developments than others and can proceed further with help while others with narrow zones cannot.

A second difficulty regarding the assessment in the zone of proximal development, is that a child will perform at a higher level in some settings than in others. This can be attributed the characteristics of the task and those of the child and also to the type of assistance given in different settings.

This implies that the nature of learning in the zone of proximal development needs further analysis. There is still a need for current research to address the “...nature of developmental processes involved in moving through one’s zone and whether they are the same at all ages (Miller 1993:415). It has been noted in the current research that no attempt has been made to examine the nature of cognitive skills necessary to provide to Wood, Bruner and Ross ’s (1976) “scaffolding”, “Rogoff’s (1990) “ joint collaborative activity, or Bandura’s (1977) “observational learning”. The study of the progression in the zone of proximal development in different cultural and historical contexts is further hindered by practical logistics such as expensive travelling, learning about other cultures, translation of material, selection of relevant testers and uninterpretable different cultural results (Miller 1993:417).

However, there is a need to review the process of teaching in the wake of the changing structure of education in South Africa. The methods used by teachers in their classrooms need to be fortified with more techniques that facilitate learning so that the traditional methods are removed from the teaching scenario once and for all.

That is why in-service courses organized for the Curriculum 20005 are highly commendable. The advocated methods of teaching need to be based on the identification of zones of proximal development, progression in these zones and the blending of Perkins' Theory One (1992) with the Tharp and Gallimore's (1988) means of assisting performance.



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**Appendix 1. Transcripts of observed lessons**

*TRANSCRIPT OF THE LESSONS TAUGHT BY TEACHER A IN SCHOOL A.*

*DATE : 11-08-97*

*CLASS : 10A*

*TIME : 10h25 - 11 h00*

*LESSON 1 : Identification of features on the map. This lesson was an introduction to the calculation of distance between features on the map although the teacher wrote the topic on the blackboard as map orientation.*

*PART ONE OF THE LESSON.*

*T: Take out your " Working with maps" [The title of the book]*

*T: [There is a short period of waiting] Turn to page 45 and tell me the title of the map.*

*Learners [in chorus form]: 2829DB.*

*T: On the map, you will find physical features and man-made features. Physical features are those that are natural and man-made features are those made by man. [Learners are attentively listening as the teacher is explaining] Right. Look at the map. Pick out one activity made by man. Yes Mafunda.*

*L1: The road.*

*T: Yes Nothemba.*

*L2: Telephone lines.*

*T: Any other, Mziwonke.*

*L3: Cultivated lands.*



*[General noise, reason unknown]*

*T: What do you say Nomfundo.*

*L4 White city. [As the answer is semi-incorrect, teacher decides to ignore it.]*

*T: Which are the natural features?*

*Learners [in chorus form] give answers as if they want to get this lesson finished .*

*Rivers; Mountains.*

*T: How do you identify mountains?*

*Learners [in chorus form] : Contour lines.*

*T: Is that OK?*

*Learners [in chorus form] Yes.*

*T: Any problems here? [ Teacher pointing in the blackboard.]*

*Learners [in chorus form] No.*

## *PART TWO OF THE LESSON.*

### *LESSON 2*

*T: How do you find direction on this map? [This question was asked three times with no response from learners]*

*Who can try? [silence] Yes, Mzuhleli.*

*L1: By means of mean magnetic declination.*

*T: Is that true? Try Lizo.*

*L2: [Guesswork allowed] We use the compass. [ This incorrect answer was ignored.]*

*T: How do you find direction? Yes, Solomzi .*

L3: *By using the scale.*

T: *[Answer ignored] How do you find the direction?*

*[ This time no response from the class.]*

T: *Look at the map of Lichtenburg. Do you see arrows on the left-hand side?*

Learners *[in chorus form]* *Yes.*

T: *What do these arrows indicate? [Teacher point at one learner] Richard.*

L4: *I don't know.*

T: *Look at this diagram. [Teacher draws a rough sketch] By using this diagram, you find North, South, East and West of any place. The true-north arrow also points at the North while the magnetic-north arrow points at the north west. Do you understand?*

Learners *[in a chorus form]* *Yes.*

T: *Where do you find Hyde Park on the map. Nosipho.*

L5: *North West.*

T: *Look at the railway line on the map. In which direction is the railway line from Ladysmith? Nozuko.*

L6: *South West.*

T: *Is that correct Mzukisi?*

L7: *South East.*

T: *I think it's correct. In which direction is Mbulawa from Ladysmith?*

L8: *West.*

T: *Is that correct?*

L9: *[In chorus form] No.*

*T: What is the correct answer?*

*L10: West.*

*T: Yes; I think it's correct.*

*[ END OF THE LESSON ]*

*TRANSCRIPT OF THE LESSON TAUGHT BY TEACHER A IN SCHOOL A.**DATE : 11-08-97**CLASS : 10B**TIME : 11h00 -11h35**LESSON II : Calculation of the magnetic declination.*

*T: Our lesson for today is magnetic declination. [ Topic written on the chalkboard while students are copying it.] Teacher draws both the true-north arrow together with the magnetic-north arrow.] The magnetic north lies to the left-hand side of the true north or west of True-North. What do you call the angle between True-North and Magnetic-North?*

*L: [In chorus form] Magnetic declination.*

*T: If the magnetic declination is 18 degrees, 5, how do you change, 5 to minutes? Can you do that?*

*Learners [ In chorus form] No.*

*L1: The answer is 18 degrees 30 minutes.*

*T: How did you get this? Please come and show us on the chalkboard.*

*L2: Multiplying 0,5 by six to make 18 degrees 30 minutes.*

*Learners: Where do you get six?*

*L2: It's actually there?*

*Learners : Where?*

*L2: Teacher said so.*

*T: Don't you know how to multiply with a decimal?*

*Learners: [In chorus form] No.*

*T: 0,5 is a fraction while six is the whole number. 6 comes from sixty minutes that make up one degree. Therefore, multiplying 60' by 0.5 is the same as multiplying 0,5 by 6 and you ignore the decimal. Then what will be the answer?*

*Learners: 30 minutes.*

*T: How do you change 16,7 degrees into minutes?*

*L3: 16 degrees 42 minutes.*

*T: OK Let's move to something else. Write this : Mean Magnetic declination 20,3 degrees West of True-North [1981].*

*Mean annual change 2' Eastwards [1975 -1980] Let's examine what this means. [Teacher pointing at 2' eastwards] If the magnetic declination in 1981 was 20,3, when you change this to minutes, what is your answer?*

*L4: 20 degrees 18 minutes*

*T: (i) Therefore, the angle of magnetic declination in 1981 was 20 degrees 18 minutes. Do you understand this Mfundo?*

*L5: No.*

*T: [Teacher gives the same explanation of converting the fraction of degrees to minutes.] [Teacher writes the following without telling students what to do.] Learners copy it from the chalkboard.*

*(ii) Between 1975 - 1980 each year the Magnetic North moved on average 2' eastwards towards the True North.*

*(iii) The angle became smaller by 2' every year between 1975 - 1980. Let's*

write this thing down. [ The thing is taken from a textbook] Calculate the Magnetic Declination.

(1) Present year/year for which you are calculating a or have been asked to e.g. 1985

(2) Map date of the Magnetic Declination e.g. 1981.

(3) Difference in years = (1) -(2)

(4) Annual change example =2

(5) Annual change multiplied by difference in years

(6) Direction of change = East [ Therefore subtract]

(7) Subtract total change = 20 18' [1981] ?? [MD for years in 1]

Let's try and calculate using this format [ Teacher pointing at the chalkboard] What is the answer for No. 1?

L1: 1985.

T: Yes; No 2.

L2: 1981.

T: No.3.

L3: 4 Years.

T: Next!

L4: 2 minutes.

T: No. 5?

L5: 2 minutes X 4 years is equal to 8 years.

T: Change of direction?

L6: East, therefore subtract.

*T: The last one is .....?*

*L7: 20 degrees 18 minutes.*

*T: All right. Calculate these for your homework. 1988, 1990, 1997*

*END OF THE LESSON*

*TRANSCRIPT OF THE LESSON TAUGHT BY TEACHER A IN SCHOOL A.*

*DATE : 14-08-97*

*CLASS : 10A*

*TIME : 9h45 - 10h20*

*LESSON : Calculating the area of a map using the ratio scale.*

*T: You all know we have different types of scales. What are they?*

*Yes Richard.*

*L1: Ratio scale*

*T: Another one?*

*L2: Line scale.*

*T: Another one?*

*L3: Representative fraction scale.*

*T: Is that all?*

*Learners [ in chorus form] No.*

*T: Which other scales do you know?*

*L4: Verbal scale*

*T: Any other?*

*Learners [ in chorus form] : No*

*T: All right. [ Teacher draws a rectangular sketch on the chalkboard] Let's assume that this is a map with a scale of 1:50000 which 1 cm on the map represents 50000 cm in reality. If 1 cm represents 50000 cm, how many centimetres will be represented by 2? Come on.*



*L5: Two centimetres will be represented by 100 000 cm.*

*T: Right: which is 1000m = 1 km Not so?*

*Learners [in chorus form] Yes.*

*T: If the length of this map is 22 cm and the breadth is 17 cm, what is the area. [ The teacher uses the drawn sketch on the chalkboard and demonstrate using a ruler.]*

*Learners used their exercise books to calculate the area of the map. Teacher realized that learners had problems with calculations that involved decimals after one girl gave the answer, 93,5 square kilometre. Teacher decided to change the units so that length was given as 28 cms and the breadth as 14 cm. [ That was more of a convenience than a rule]*

*T: What is the answer now?*

*Learners [ in chorus form]: 98 square kilometres.*

*T: Can you see that we can calculate the area of the map using the ratio scale ?*

*Learners [ in chorus form-to satisfy the teacher] Yes.*

*T: Bear in mind that when you use the ratio scale the answer will be in square kilometres.*

*Also bear in mind that you simple divide by two to get kilometres.*

*END OF LESSON*

TRANSCRIPT OF THE LESSON TAUGHT BY TEACHER A IN SCHOOL A.

DATE : 14-08-97

CLASS : 10A

TIME : 11h15 - 11h50

LESSON : Calculating the area of the map using the line scale.

*[While the teacher was still having a look at his text and paging here and there, the class started making noise and no attention was paid to them.]*

T: Right OK now. Will everybody be attentive. Now we are going to connect the line scale with the areas of the map. *[After a brief explanation of different types of scale, the teacher poses a question]* What is a line scale? *[After a remarkable silence, the teacher decides to give them the answer.]* You have a line like this with distances marked off from that line. Teacher uses a sheet of paper to demonstrate how a three kilometre line can be marked off in equal distances.

T: Do you agree with us?

Learners *[in chorus form]* Yes.

T: Do you remember how to find an area of a map using the line scale?

Learners *[in chorus form]* No?

T: Here is step one. If the length is 2 km and the breadth is 1 km, then the area will be .....

Learners *[in chorus form]* 2 square kilometres.

T: Let us say we have a line scale marked up to 300 metres; if we want to know the area we measure length and breadth of the map starting from zero of the line scale. That will give us

*the length and breadth of the map after which you multiply. Let us say the length is 250 metres and the breadth is 120 metres, what is the area?*

*Learners [ They began to calculate on their exercise books and after some time the teacher intervened]*

*T: What is the answer? Yes; Bongiwe.*

*Learner : 3000 square metres.*

*T: Any other answer?*

*L1: 3000 square metres.*

*T: Is that correct?*

*L2: 45000 square metres.*

*T: 30000 square metres is correct [ Teacher did not show how he arrived at that answer].*

*As the learners were still trying to get the correct answer, more noise started pouring in because they were discussing with each other.]*

*T: Let us say we have airport on this map .....*

*THE BELL RINGS AND MARKS THE END OF THE LESSON*

*TRANSCRIPT OF THE LESSON TAUGHT BY TEACHER A IN SCHOOL A.*

*DATE : 18-08-97*

*CLASS : 10B*

*TIME : 10h25 - 11h00*

*LESSON : The gradient in slopes*

*T: [ Teacher wrote the topic of the lesson & drew a diagram] If you have a school here and a shop here, what type of slope do you have in between these two places?*

*L1: A steep slope.*

*T: If it looks like this?*

*Learners [ in chorus form] A gentle or flat slope.*

*T: O.K. Look at this other diagram. What is the other term used to describe the ground level between A and B ? Yes Nomgcobo.*

*L2: It is a horizontal distance.*

*T: Between A and C ?*

*Learners [ in chorus form] the vertical distance.*

*T: What does the gradient tell us about ? Nomfundo.*

*L3: [no response from Nomfundo]*

*T: Can you try Mziwonke?*

*L4: [ No response from Mziwonke]*

*T: The gradient tells us about the average steepness of a slope.*

*Can you say that all of you?*

*Learners [in chorus form] Gradient tells us about average steepness of a slope. [ The teacher*

wrote this on the chalkboard.]

T. Write also this definition of a gradient: The gradient is the relationship between:

- (1) how high you have climbed.
- (2) how far you have walked on the horizontal surface.

Right; Look at this diagram. If the vertical distance is 50 metres and the horizontal distance is 100 metres, then this means fifty over hundred which is equal to  $\frac{1}{2}$  which is vertical distance over horizontal distance. 1 is to 2 means that for every two metres you move horizontally, you climb by 1 metre. Here is an example. If on a map with a scale 1:50 000, there is a spot height which 150 metres and on trigonometric beacon no.88 the height is 200 metres, calculate the gradient. Remember 2 centimetres is equal to 1 kilometre which is equal to 10000 metres. All right. Before you go to this exercise, let me give you an example where the gradient between two points is vertical interval, which is 50 metres and the measured distance between the same points is 4 centimetres. The gradient will be 1:40. Now calculate this. [ The teacher wrote on the chalkboard fifty metres over three centimetres and waited for children to calculate. [ It is after a time he asked :] What is the correct answer?

L5: 1:30

T: O.K. If I made fifty over three thousand instead of fifty over one thousand five hundred?

L: [After a short period of silence one learner gave the answer] One is to sixty.

T: Always remember these: One centimetre is equal to zero comma five kilometres which is equal to five hundred metres. Any questions?

Learners [in chorus form] No.

END OF LESSON

*TRANSCRIPT OF THE LESSON TAUGHT BY TEACHER A IN SCHOOL A.*

*DATE : 18-08-97*

*CLASS : 10B*

*TIME : 11h00 -11h35*

*LESSON : Aerial photographs*

*T: Write this heading first. [ This refers to the lesson topic] Have you finished Nontsundu? Pengwa we are waiting on you. O.K. Open your books on page 45. What do you see on page 45 Simiso?*

*L1: Roads.*

*T: Lindelwa.*

*L2: Buildings*

*T: Nombuso. What is page 44?*

*L3: A topographical map.*

*T: Thank you. What makes you think page 44 and 45 are same [a leading question] Yes E-e-h Goodman.*

*L4: There is an aerodrome on both pages.*

*T: Why do you say they are not the same?*

*L5: There are no cultivated lands in the photograph.*

*T: That's a brilliant answer. Is there anyone who wants to challenge this answer? Simiso. What do you say?*

*L6: Cultivated lands are there as photographed.*

*T: OK, let's proceed. We define an aerial photograph in terms of how it is taken. Like this. [Teacher pointed at the photograph on the text] Aerial photograph are taken by an aircraft. Let me show you how photographs are taken. This is the ground level with buildings and all. The camera of the aircraft takes all features above the ground level. Can I explain to you how a vertical aerial photograph is taken? [No response from learners] It is taken with camera pointing down at 90 degrees. Now turn to page 54. Can you see that the picture on page 54 is different from that one on page 45?*

*Learners [in chorus form] Yes.*

*T: Please pay attention to this Simiso, you mentioned an aerodrome. Are they the same on the map and on the photo?*

*Learners [in chorus form] No.*

*T: Use a ruler or a piece of paper to measure it. [Not a single learner had a ruler except the teacher. Teacher went round to check whether there was any measurement going on. The amount of noise was increasing as they were doing the paper measurement.] Measure the distance on the map and the same distance on the photograph. Simiso says they are the same and the class says*

*No. Which is which? [After a time, one learner responded.]*

*L7: They appear to be the same because we have no rulers. [Laughter]*

*T: Is that the correct reason?*

*L8: No. They are the same because we find the same measurement with our paper.*

*T: Your papers cannot be accurate. Look. As I measure with my ruler I find that the distance on the map is 10 cm and the distance on the photograph is 20 cm. Then what is the scale of*

*the photograph? Let's work it out. Scale is equal to photo distance over map distance times one over 50000. Calculate this everybody. What is the answer?*

*L9: The answer is, one is to twenty five thousand.*

*T: How did yo get it? Come show us on the chalkboard. That is correct. You have got it.*

*Let me give you this final example for your homework. Copy this example on the chalkboard.*

*Here is one of your homework.*

*Map distance = 8cm*

*Photo distance = 24cm*

*Map scale = 1:50 000*

*END OF THE LESSON*



TRANSCRIPT OF THE LESSON TAUGHT BY TEACHER B1 AT SCHOOL B.

DATE : 25-08-97

CLASS : 10A

TIME : 12h15 - 12h55

LESSON : Measurement of distance

T: [Teacher draws a rectangular diagram which represents a map. A line was drawn between point A and point B and scale of 1:50 000 was written on it ....] What does this mean? 1:50 000? [When learners did not respond to the question, teacher answered it himself] It means 1 cm is to 50 000 cm. How do we convert this to kilometres?

L1: We divide by 100000 cm.

T: Why?

L2: We change centimetres to kilometres.

T: What is this?  $\frac{1}{2}$  [50 000 / 100 000]

Learners [ in chorus form] Half of a kilometre.

T: How do you convert this  $\frac{1}{2}$  to a decimal?

L3: 0,5 km

T: If the distance on a map is 20 cm, what is the actual distance?

L4: 10. km

T: How do you arrive at that?

L5: Divide twenty by 2.

T: Why?

*L: [No response from learners]*

*T: We multiply twenty by one over two. Take out your "Working with maps" and turn to page*

*33. I want you to find out the distance from Chavannes to Worcester railway station.*

*[Learners first used papers to measure distance after which the measurements were checked by using the rulers. Some learners were using strings or twines.] What is the answer?*

*L6: From Chavannes to Worcester railway station, is 12,5 cm.*

*T: What is the actual distance?*

*L7: 6,25 km.*

*T: Is there anyone who got a different answer?*

*L8: Yes -13 cm.*

*T: It depends on how you measure it 6,25 km is the correct answer.*

*END OF THE LESSON*

TRANSCRIPT OF THE LESSON TAUGHT BY TEACHER B1 AT SCHOOL B.

DATE : 25-08-97

CLASS : 10A

TIME : 11h30 -12h10

LESSON : Problems involving time, speed and distance.

[ Teacher writes the lesson topic on the chalkboard]

T: What is the distance from this school to town?

L1: 11 kilometres.

[ Teacher writes this problem on the chalkboard]

T: If we are walking 2,5km [speed] per hour, how long it takes us to walk to town will give us time.

Distance = Speed x Time [equation]

If a train travels at 20 km/h, how long will this journey last?

[Time] in minutes. It is not necessary to memorize the formula. If we want speed we calculate like this :-

$[(\text{Distance}/\text{Speed}) = (\text{Speed} \times \text{Time})/\text{Speed}]$  Cancel here, here and here.

Coming back to our example if we want time it will be

Time = (6,5 km) / (20 km/h)

= 0,325 h.

How do we change this to minutes?

L2: We multiply 0,325 by 60 minutes and the answer is 19,5 minutes.

*T: Now, I want someone to come to the blackboard and calculate this exercise. If a train travels at 48 km/h how long will this journey last [ in minutes ] if the distance is 6,5 km.*

*[ One learner volunteered and demonstrated on the chalkboard while others were watching. To get the correct answer she used her own calculator.] Thank you. We will continue with this lesson next time.*

*END OF THE LESSON*

*TRANSCRIPT OF THE LESSON TAUGHT BY TEACHER B1 AT SCHOOL B.*

*DATE : 28-08-97*

*CLASS : 10A*

*TIME : 13h00 - 13h40*

*LESSON : Problems involving distance, time and speed.*

*[ This was a continuation of a lesson which had not been finished. The teacher wrote the exercise on the chalkboard ]*

*T: [if a train travels 6,5 km in 20 minutes, find the speed of the train .]*

*The equation is :-*

$$D/T = [TXS] / T$$

*How do you cancel the equation? [Nosipho cancelled the equation.]*

*Now we are left with this equation.*

$$S = D/T$$

*What must we do now? First change 20 minutes to hours. Like this :*

$$20/60 = 0,333333...hr$$

*Therefore the speed is 6,5 km / 0,333.*

*Secondly, divide this using your calculator. What is your answer?*

*Learners [in chorus form] 19,7 km per hour.*

*T: Here is your example to calculate the speed is 48 minutes and the distance is 6,5 km. What is the distance in kilometres per hour? [Teacher went round checking how the learners were calculating. Finally, one student was requested to calculate on the chalkboard. The learner*

wrote this on the chalkboard :

$$D = 6,5 \text{ km}$$

$$T = 48 \text{ MINUTES} = 0,8 \text{ hours}$$

$$S =$$

$$S = D/T$$

$$= 6,5/0,8h$$

$$= 8,125 \text{ km/h}$$

*T:* Check if this one [0,125 km] is more than 5, then it would be 8,9 km/h.

*Any question?*

*Learners [in chorus form] No.*

*END OF THE LESSON*

*TRANSCRIPT OF THE LESSON TAUGHT BY TEACHER B2 AT SCHOOL B.*

*DATE : 01-09-97*

*CLASS : 10C*

*TIME : 13h00 -13h40*

*LESSON : Scale conversion.*

*T: By the end of the lesson you will be knowing the following :-*

*[Teacher writes on the chalkboard] Scale conversion. What is a map?*

*Learners : [No response]*

*T: A reduced representation of reality. What is a scale?*

*Learners: [No response]*

*T: A degree of reduction. What are the different scales?*

*Learners: [No response]*

*T: What's wrong with you ? Why are you not answering my questions? Is it because there is a visitor in our class? Please respond when.*

*Learners: [Different types of scales were given by learners such as Ratio, Linear, Fraction and Word scale.]*

*T: How else do we term the linear scale?*

*L1: Line scale or Bar scale.*

*T: What about the word scale?*

*L2: It is the statement or verbal scale.*

*T: Give an example of ratio scale. Come and write here, Sigudu.*

L3: 1:50 000 [written by the learner on the chalkboard]

T: What does 1:50 000 mean?

L4: 1 cm on map... [ interruption]

T: No mehn. I told you long ago not to answer me like that. This scale does not mean that ... What does this mean ? [Silence] This means that the actual ground has been reduced 50 000 times to fit it on paper. Let's come to the fraction scale. How do we do it? [instead of how do we write it? ] Come Nonyameko.

L5: 1/[50 000] [ written on the chalkboard by the learner]

T: The word scale? Siyabonga.

L6: One centimetre on the ... [ student stopped]

T: Hey you! How do you listen? Did I not tell you that I do not want that old definition? [Another student was called and wrote 1 cm:0,5]. You are also messing me around. This is written like this 1 cm: 0,5 km. Is 1:50 000 the same as 1 cm:0,5 km?

Learners [in chorus form] No.

T: How have we changed this?

L7: We divide the number which makes it and divide by it.

T: I don't understand what you are trying to say. All right. How many centimetres which make a kilometre?

L8: 100 cm.

T: Do you know a metre stick? Does it make a kilometre? Yes Hlubukazi.

L9: 100 000cm.

T: How do you calculate this [50 000] / [10 000]? Mthiyane



L10: 0,5 km.

T: Calculate the following: [written on the chalkboard by the teacher]

(1)  $1\text{ cm} = 15\ 000\text{ cm}$ .

(2)  $1/[30\ 000]$ .

(3)  $1\text{ cm} = 100\ 000\text{ cm}$ .

When changing this to a word scale, it will look like this:  $1\text{ cm} = 0,5\text{ km}$

[ While some learners were calculating, others were making noise, trying to find out what answer others got. Some learners were looking for their books and consequently delaying the proceedings of the lesson. Few had calculators, rulers and instrument boxes. Others were sharing the calculation text. " Working with maps" .....

After some time the teacher exclaimed: " Right. Change your books. Who can help us with No.1 ? Any other who is still writing? Raise your hands; I don't want chorus answering. Which procedure are we following?

L11: Map distance is divided by scale.

T: Wrong. What about you Zolani?

L12: Take the number which makes a kilometre and divide by it.

T: Any others who got 0,15 or zero comma one five? What about No. 2

L13: 0,3 km.

T: Come and write here. [ wrote on chalkboard] No. 3?

L14:  $1\text{ cm} = 1\text{ km}$ .

T: The period has ended. See you next time.

END OF THE LESSON

TRANSCRIPT OF THE LESSON BY TEACHER C AT SCHOOL C.

DATE : 08-09-97

CLASS : 10 A

TIME : 12h00 - 12h35

LESSON : Distance.

T: OK. Let's be ready. Form up your groups. Our lesson is on distance. [ Distance written on chalkboard] The distance will be measured on the map in centimetres and converted to kilometres and metres. Take out your mapwork books and turn to page 34. Find the distance between Trig.beacon no. 68 and the railway line. If you have got your distance tell me.

L1: 5.7 cm

T: How do we calculate kilometres?

L: We multiply 5.7 cm by 10 000

T: I don't think that is correct. There are three methods of calculating kilometres. Let's look at these methods. In the first method, you multiply your measured distance by 50 000 and divide by 100 000.

For example :

$$[5.7 \times 50\,000] / 100\,000 = 2.8 \text{ km [Demonstrated by the teacher]}$$

In the second method you divide your measured distance by 2.

*For example :*

$$[5.7]/2 = 2.85 \text{ km [Demonstrated by the teacher]}$$

*In the third method, you multiply your measured distance by 1/2 or 0,5.*

*For example,*

$$(i) 5.7 \times 1/2 = 2.85 \text{ km [ Demonstrated by the teacher]}$$

$$(ii) 5.7 \times 0,5 = 2.85 \text{ km [ Demonstrated by the teacher]}$$

*Let's now convert centimetres to kilometres.*

*L2: Sorry Mam. I don't understand the third method.*

*T: Maybe you don't know how to multiply fractions. Assist him in that group using a calculator. Now let's convert centimetres to metres. Let's use that same example of 5.7 cm.*

*How do we do it ? We use two methods. In the first method we multiply the measured distance by 50 000 and divide by 100 .*

*For example :*

$$[5.7 \text{ cm} \times 50\,000] / 100 = 2850 \text{ [Demonstrated by the teacher]}$$

*In the second method, you first divide the measured distance by 2 and multiply the result by 1000.*

*For example :*

$$[5.7] / 2 = 2.85 \text{ km} \times 1000 = 2850$$

*Any questions or problems?*

*Learners : No.*

*END OF THE LESSON*

TRANSCRIPT OF THE LESSON TAUGHT BY TEACHER C SCHOOL C.

DATE : 08-09-97

CLASS : 10A

TIME : 12h35 - 13 h10

LESSON : Calculations of the scale of a photograph.

T: [ Teacher wrote : Scale of a photograph on the chalkboard]

Turn to page 45 of your mapwork books. Do you see the aerodrome?

Measure it and find the scale. The formula for this is :

Scale = [ Photo distance x Map scale / Map distance

[ written by teacher on the chalkboard]

Find the distance in mm and not in cm

LEARNERS: Group started discussing how to solve the given problem. Each had at-least one calculator.

T: Yes Mdzinwa. what's your measurement.

L1: I got 20 mm.

T: Any different answer?

L2: Yes Mam. I got 19 mm.

One Group : No its 21 mm. 19 mm and 20 mm are wrong.

*T: All right. Let's take 21 mm [ Teacher used a calculator and came up with the answer].*

*The answer is 1: 476. 190 cm or mm*

*L3: Where do you get that 1 Mam?*

*T: Always a scale is 1 to something.*

*L3: But the answer we get in our group is 476190.3*

*L4: Do you put a comma anywhere you like Mam/*

*T: No. You don't do that.*

*L5: In the examinations how can this be asked?*

*T: Don't worry about that . We will come later to that.*

*In your groups, measure any two points on the map and see whether you get the same answer.*

*Let's forget about the previous example.*

*[ The group started measuring and calculating until the bell for lunch rang]*

*All right. It's time now. You can go. We will continue tomorrow.*

*END OF THE LESSON*

PO Box 447  
MOUNT FRERE

08 August 1997

THE DISTRICT MANAGER  
EDUCATION DEPARTMENT (A)

TABANKULU

Sir/Madam

**PERMISSION FOR CLASSROOM OBSERVATION**

This is to request your office to grant me permission to visit some schools in the area of your operation for the purpose of observing Geography lessons during this month of August. This class observation is part of the research project which is conducted under the auspices of the University of Natal.

Part of this research project refers to the extent to which <sup>Standard</sup> ~~std~~ 10 students acquire Geography numeracy skills through various teaching methods. Such a research is a sequel to the high failure rate which is evidenced in the Geography calculations which form part of paper 1 in the final examinations.

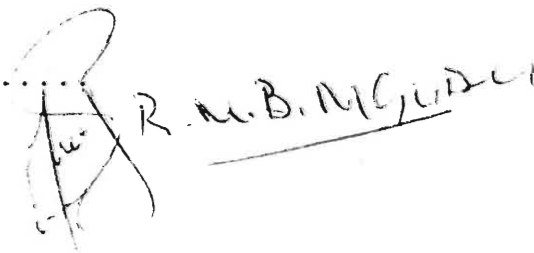
Yours faithfully



(MR M M MBUCE)

PERMISSION GRANTED / NOT GRANTED

.....  
DESIGNATION

  
R. M. B. M. Mbuce

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MOUNT FRERE

08 August 1997

THE DISTRICT MANAGER  
EDUCATION DEPARTMENT (B)  
MOUNT FRERE

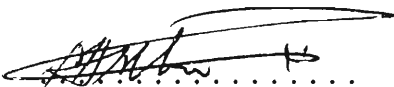
Sir/Madam

PERMISSION FOR CLASSROOM OBSERVATION

This is to request your office to grant me permission to visit some schools in the area of your operation for the purpose of observing Geography lessons during this month of August. This class observation is part of the research project which is conducted under the auspices of the University of Natal.

Part of this research project refers to the extent to which <sup>Standard</sup> ~~std~~ 10 students acquire Geography numeracy skills through various teaching methods. Such a research is <sup>a</sup> sequel to the high failure rate which is evidenced in the Geography calculations which form part of paper 1 in the final examinations.

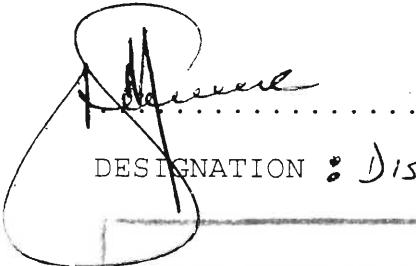
Yours faithfully



(MR M M MBUCE)

UNIVERSITY OF NATAL SCHOOL OF EDUCATION
08 -8- 1997
PRIVATE BAG X01 SCOTTSVILLE 3209

PERMISSION GRANTED / ~~NOT GRANTED~~



DESIGNATION : DISTRICT MANAGER

DEPT. OF EDUCATION P Bag X001 MOUNT FRERE OFFICE STAMP.
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PO Box 447  
MOUNT FRERE

08 August 1997

THE DISTRICT MANAGER  
EDUCATION DEPARTMENT

MT AYLIFF (c)

Sir/Madam

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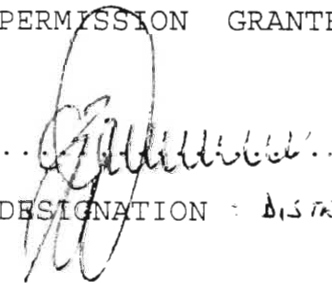
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DESIGNATION : DISTRICT MANAGER

UNIVERSITY OF NATAL  
SCHOOL OF EDUCATION

08 - 8 - 1997

PRIVATE BAG X01  
SCOTTSVILLE 3209

OFFICE STAMP.

MAPWORK CALCULATIONS1. SCALE

## 1.1 Distance on a 1:50 000 topo map:

Distance outside in km = Distance on map in cm  $\div$  2

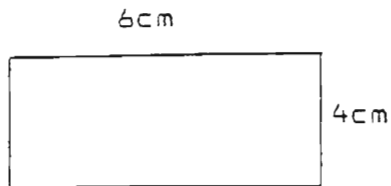
eg Distance on map = 15,6 cm

Distance in km =  $15,6 \div 2 = 7,8$  km

## 1.2 Area on a 1:50 000 topo map:

NB First convert map distances to km, then calculate area.

eg



6 cm ----&gt; 3 km

4 cm ----&gt; 2 km

Area = 3 km X 2 km  
= 6 km

With triangular shapes use formula:

 $\frac{1}{2}$  base length of triangle X height of triangle

Convert map distances to km, then calculate area.

## 1.3 Scale of vertical aerial photograph:

METHOD 1: Using the focal length of the camera and the height of the plane above the ground.

(NB Do not confuse ground with sea level)

Use formula: Scale of photo =  $\frac{\text{focal length (f) of camera}}{\text{height above ground (H)}}$ 

eg f = 150 mm (you will find f at the top of the photo)

H = 1 500 m (you may have to calculate the height of the land in the centre of the photo and subtract it from the altimeter reading shown at the top of the photo)

$$= \frac{150 \text{ mm}}{1\,500 \text{ m}}$$

$$= \frac{150 \text{ mm}}{1\,500 \text{ m} \times 1000 \text{ (to convert to mm)}}$$

$$= \frac{150 \text{ mm}}{1\,500\,000 \text{ mm}}$$

$$= \frac{1}{10\,000}$$

$$= 1:10\,000$$

METHOD 2: Using a distance between two points shown on both the map and the photo.

Step 1: Measure a linear feature on the map that is also found on the photo, eg a road or the distance between two intersections,

and convert this distance to km by dividing by 2 (assuming the map has a scale of 1:50 000).

Step 2: Measure the same distance on the photo. This measured distance on the photo represents the distance calculated in step 1.

Step 3: Divide the distance in km by the distance measured on the map. to yield a scale of 1 in ????????

EXAMPLE Measured distance between 2 points on map = 6 cm  
Convert distance to km =  $6 \div 2 = 3$  km

Measured distance between same points on photo = 15 cm

ie 15 cm on photo represents 3 km in reality

1 cm represents  $3\,000\text{ m} \div 15 = 200\text{ m}$

→ 1 cm represents 20 000 cm

Scale of photo is therefore 1:20 000

NB: ALWAYS USE A COMMON UNIT OF MEASUREMENT IN CALCULATIONS! DO NOT USE CM AND METRES, CONVERT CM TO METRES, OR PREFERABLY METRES TO CM.

SHORT CUT FORMULA:  $\frac{\text{Distance on photo}}{\text{Distance on map}} \times \text{Scale of map}$

ie  $\frac{15}{6} \times \frac{1}{50\,000}$

=  $\frac{15}{300\,000}$

→ =  $\frac{1}{20\,000}$

= 1:20 000

NB ALWAYS REDUCE THE NOMINATOR TO 1 (IE  $15 \div 15$ ), THEN DIVIDE THE DENOMINATOR BY THE NOMINATOR (IE  $300\,000 \div 15$ ).

## 2. GRADIENT

Formula: Gradient =  $\frac{\text{Vertical Interval}}{\text{Horizontal Equivalent}}$

ie

Gradient =  $\frac{\text{Height difference between top and bottom of slope}}{\text{Distance between the points in metres}}$  <

Use scale  
Use contours

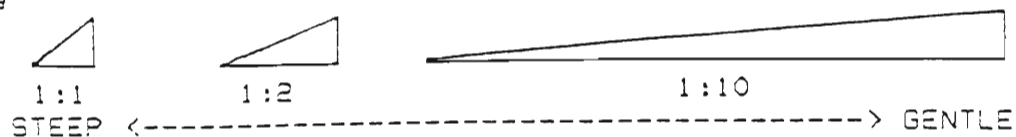
NB ALWAYS REDUCE THE NOMINATOR TO 1, THEN DIVIDE THE DENOMINATOR BY THE NOMINATOR TO GET 1 IN SOMETHING

What does the gradient 1 in 500 actually express?  
 It states that one must travel 500 units horizontally (HE) to ascend by 1 unit (VI).

The gradient 1 in 500 can also be written as a representative fraction 1:500, or as a fraction  $\frac{1}{500}$ .

NB: ILLUSTRATE DIFFERENT GRADIENTS FOR THE PUPIL.

eg



The smaller the representative fraction, the gentler the gradient.

### 3. VERTICAL EXAGGERATION

Cross sections must have an exaggerated vertical scale, otherwise, the rise and fall of the land depicted will be too gentle to see on the cross section.

VE expresses how many times the vertical scale used in a cross section drawing is greater than the horizontal scale.

Normally the vertical scale of the cross section lies between 4 times the horizontal scale and 7 times the horizontal scale. A VE of 5 times is easiest to work with.

If the scale of the map is 1:50 000, ie  $\frac{1}{50\,000}$

then the vertical scale ought to be  $\frac{1}{50\,000} \times 5$  (to be 5 X larger)

$$= \frac{1}{10\,000} \text{ or } 1:10\,000$$

This means that when the vertical axis for the cross section is drawn 1 cm on the axis will represent 10 000 cm or 100 m.

Conversely, if you want to calculate the VE of a cross section that you have not drawn, then use the formula:

$$VE = \frac{\text{Vertical Scale}}{\text{Horizontal Scale}}$$

and use the following steps:

1. Use a ruler along the vertical axis to find out what 1 cm represents, eg 1 cm may represent 100 m.
2. Express the vertical scale by using a common unit  
 eg 1 cm represents 100 m ---> 1 cm represents 10 000 cm.

Vertical Scale (VS) is 1:10 000 or  $\frac{1}{10\,000}$

3. Look for the horizontal scale of the map, eg 1:50 000  
which is the same as  $\frac{1}{50\ 000}$

4. Apply the formula:

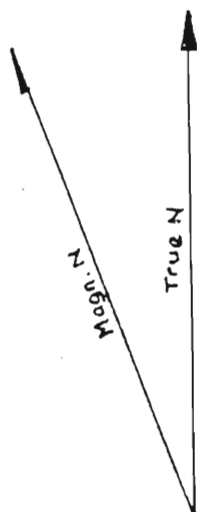
$$\begin{aligned} VE &= \frac{\frac{1}{10\ 000}}{\frac{1}{50\ 000}} \\ &= \frac{1}{10\ 000} \times \frac{50\ 000}{1} \\ &= \frac{50\ 000}{10\ 000} \\ &= 5 \text{ times} \end{aligned}$$

#### 4. BEARING

Bearing is the angular measurement of a place from north. It is always measured in a clockwise direction from north. Bearing can be expressed as a true bearing (measured on the map using a protractor), or as a magnetic bearing (by including the magnetic declination in the calculation).

##### How to measure bearings using a S.A. topographical map

- STEP 1 Draw a line parallel with the maps margin through the position from which the bearing is to be measured. This line points to true north (also called grid north).
- STEP 2 Draw a line connecting the place from which the bearing is to be calculated to the place to which the bearing is to be calculated.
- STEP 3 Use a protractor to measure the angle - this is the TRUE BEARING.
- STEP 4 Examine the information on the left hand side of the map to calculate the MAGNETIC DECLINATION.



Mean magnetic declination 23,6° West of True North (1980.0). Mean annual change 3' Eastwards (1972 - 1975)

Three pieces of information must be sought:  
 \* the angular difference between true north and magnetic north;  
 \* the rate at which this angle is changing;  
 \* the year in which the map was printed.  
 These pieces of information have been marked in the example above.

STEP 5 Calculate the magnetic declination for the present. Using the example above:

The magnetic declination in 1980 was  $23^{\circ} 36'$ .

The mean annual change is  $3'$  eastwards; therefore as 13 years have elapsed (1980 to 1993) since the map was published, the magnetic declination has grown smaller by  $39'$ . The present magnetic declination is therefore  $23^{\circ} 36'$  minus  $39' = 22^{\circ} 57'$ .

STEP 6 ADD the magnetic declination to the true bearing.

**NOTE** To convert a true bearing to a magnetic bearing ADD the magnetic declination to the true bearing.  
 To convert a magnetic bearing to a true bearing SUBTRACT the magnetic declination from the magnetic bearing.

#### How to convert a bearing to a back bearing.

If a bearing is taken from A to B then the BACK BEARING is the bearing from B back to A.

The back bearing is calculated by either:

ADDING  $180^{\circ}$  to the bearing if the bearing is SMALLER than  $180^{\circ}$ ,  
 or by

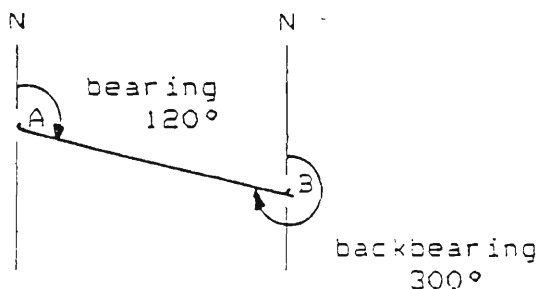
SUBTRACTING  $180^{\circ}$  if the bearing is SMALLER than  $180^{\circ}$ .

#### EXAMPLES:

Bearing =  $120^{\circ}$

As bearing is smaller than  $180^{\circ}$  ADD  $180^{\circ}$

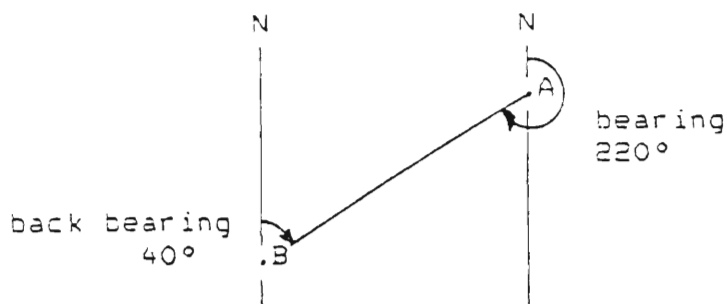
Backbearing is therefore  $120^{\circ} + 180^{\circ} = 300^{\circ}$



Bearing =  $220^{\circ}$

As bearing is greater than  $180^{\circ}$  SUBTRACT  $180^{\circ}$

Backbearing is therefore  $220^{\circ} - 180^{\circ} = 40^{\circ}$

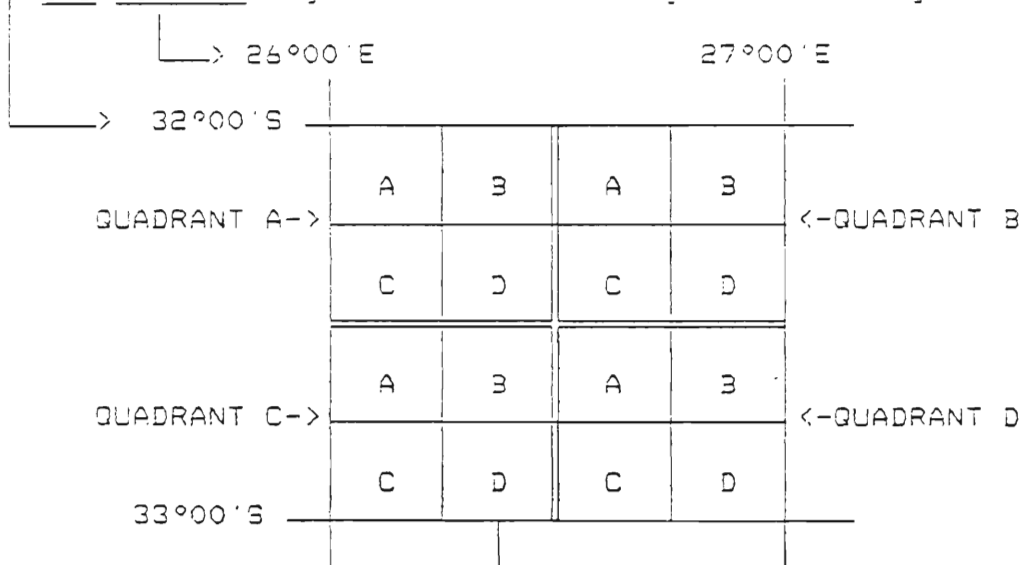


## 5. MAP HEADINGS

Each square degree of latitude and longitude that covers SA contains 16 maps. All these maps are prefixed by the same four digits. The letters following the digits differ according to the map's position within the quadrant in that square degree.

The first two digits refer to the line of LATITUDE that runs along the NORTHERN edge of the square degree.

The second two digits refer to the line of LONGITUDE that runs along the WESTERN edge of the square degree (see diagram below).



→ This map D is in QUADRANT C  
 The square degree is bounded in the N by 32°00'S  
 The square degree is bounded in the W by 26°00'E  
 Its heading therefore is 3226CD.

The map directly south of 3226CD is in a different square bounded by 33°00'S and 26°00'W.  
 It is in quadrant A and it is map B.  
 Its heading therefore is 3326AB.

## 5. ORTHOPHOTO HEADINGS

There are 25 photographs for every topographical map arranged in 5 rows with 5 photographs in each row. Photograph number 1 is located in the top left hand corner and each row is read from left to right as you would read this page. Photograph number 25 is located in the bottom right hand corner.

The photograph heading adopts the heading of the topo map and to this number is added the photograph number.

### EXAMPLE:

Using the example in the previous section, 3226CD 15 would pertain to the last photograph in row 3 and would cover a portion (1/25) of the topo map 3226CD.



Appendix 4 : Distribution of Standard 10 learners according to beginners, repeaters, age and gender in the following :-

SCHOOL A :STANDARD 10 GEOGRAPHY STUDENTS.

	ENROLMENT		MATHS STUDENTS.			
	FEMALE STUDENT	MALE STUDENT	FEMALE	MALE	TOTAL: MATHS STUDENT	TOTAL: ENROLMENT
REPEATERS	10 79.9%	3 23.1%	5 83.3%	1 16.7%	6 31.6%	13 16.9%
BEGINNERS	45 70.3%	19 29.7%	9 69.2%	4 30.8%	13 68.4%	64 83.1%
AGES 16-18	14 60.9%	9 39.1%	4 66.8%	2 33.3%	6 26.1%	23 29.9%
AGES 19-21	32 84.2%	6 15.8%	7 77.8%	2 22.2%	9 23.7%	38 49.4%
AGES 22-25	5 50.0%	5 50.0%	2 66.7%	1 33.3%	3 30.0%	10 13.0%
AGES 25&OVER	5 83.3%	1 16.6%	1 100%	0 0.00%	1 16.7%	6 7.8%
TOTALS	55 71.4%	22 28.6%	14 73.7%	5 26.3%	19 24.7%	77 100%

SCHOOL B : STANDARD 10 GEOGRAPHY STUDENTS.

ENROLMENT	MATHS STUDENTS.
-----------	-----------------

	FEMALE STUDENT	MALE STUDENT	FEMALE	MALE	TOTAL: MATHS STUDENT	TOTAL: ENROL MENT
REPEATERS	0 0.00%	0 0.00%	0 0.00%	0 0.00%	0 0.00%	0 0.00%
BEGINNERS	43 53.8%	37 46.2%	14 51.9%	13 48.1%	27 33.8%	80 100%
AGES 16-18	13 65%	7 35%	9 64.3%	5 35.7%	14 70%	20 25%
AGES 19-21	22 46.8%	25 53.2%	5 45.5%	6 54.5%	11 23.4%	47 58.8%
AGES 22-24	7 58.3%	5 41.7%	0 0.00%	1 100%	1 83.3%	12 15%
AGES 25&OVER	1 100%	0 0.00%	0 0.00%	0 0.00%	0 0.00%	1 1.3%
TOTALS	43 53.8%	37 46.2%	14 51.9%	13 48.1%	27 100%	80 100%

SCHOOL C :STANDARD 10 STUDENTS.

	ENROLMENT		MATHS STUDENTS			
	FEMALE STUDENT	MALE STUDENT	FEMALE	MALE	TOTALS: MATHS STUDENT	TOTALS FOR ENROLM ENT
REPEATERS	3 100%	0 0.00%	3 100%	0 0.00%	3 12%	3 12%
BEGINNERS	9 40.9%	13 59.1%	9 40.9%	13 59.1%	22 88%	22 88%
AGES 16-18	8 61.5%	5 38.5%	8 61.5%	5 38.5%	13 52%	13 52%
AGES 19-21	3 33.3%	6 66.7%	3 33.3%	6 66.7%	9 36%	9 36%
AGES 22-25	1 33.3%	2 66.7%	1 33.3%	2 66.7%	3 12%	3 12%
AGES 25 &OVER	0 0.00%	0 0.00%	0 0.00%	0 0.00%	0 0.00%	0 0.00%
TOTALS	12 48%	13 52%	12 48%	13 52%	25 100%	25 100%