Explaining Successful Matriculation Science Classrooms in Under-Resourced Environments

By

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Abstract

In South Africa, the matriculation results receive much public attention. Each year, the matriculation results indicate that a number of schools are providing a sound education to their learners, whether they are resourced or under-resourced, urban or rural.

This study investigates strategies employed by teachers who teach in under-resourced environments. The sample of the study consists of four schools in the Ulundi Region of the KwaZulu Natal province.

Interviews, questionnaires and classroom observations were the instruments used to capture data. The study explains why some schools with limited resources achieve good science results at matriculation level. The findings from this study have been synthesised to identify characteristics that explain school effectiveness in the selected schools.

I have also presented the implications based on the findings of the study. These implications will be useful to science teachers who teach in schools with limited resources and science education researchers to question about what is happening in effective schools.

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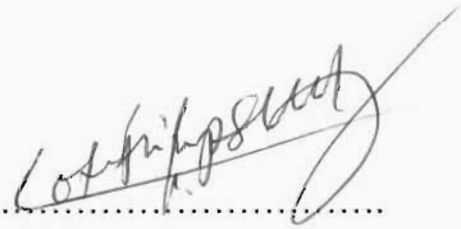
DECLARATION

I DECLARE THAT THIS DISSERTATION:

"Explaining successful science performance at matric level in under-resourced environments, especially those from rural underdeveloped areas"
is my own work.

Further more, this dissertation was not submitted to any other university for examination.



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SIGNATURE DATE

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CHAPTER 1

THE RESEARCH CONTEXT

1. INTRODUCTION TO THE STUDY

1.1 MOTIVATION FOR THE STUDY

I am not from this part of Africa. But for the past six (6) years I have taught physical science in rural schools in the Ulundi Region of KwaZulu Natal (KZN), South Africa. Ulundi represents one of the poorest educational regions in the province. I noticed differences between schools in the South African system of education in general, vis-à-vis the situation in the Ulundi Region. I observed that despite the lack of resources in most schools, some schools still achieved good science results at matriculation level. I have been motivated therefore, to do a study on effective schools to investigate what factors explain the high level of science achievement in schools with limited resources, especially those from rural underdeveloped areas.

This Chapter will highlight the background of the educational system in South Africa; describe the context of science teaching in the Ulundi Region of the KwaZulu Natal (KZN) province; provide a brief profile of the sample schools; explain the purpose of this research; outline the critical research questions; state the rationale for the research; describe the methodological strategies employed; and identify the limitations of this study.

1.2 THE POLICY CONTEXT

A short discussion of the South African system of education is necessary to give insight into the type of education that existed in South Africa over the past years in order to understand the present situation. Black Education in South Africa has been in crisis at least since the introduction of Native Education and Bantu Education (Hartshorne, 1992; Kallaway, 1985). Black Education in this study refers to the type of education that was offered to the indigenous Africans in South Africa under white minority rule. Black Education in the country has been inferior in comparable terms to other racial groups (Hartshorne, 1992). Many Black students attended the least adequately funded schools, with the least qualified teachers, poorest facilities and the largest class sizes during the apartheid period. Greenstein (1996) also asserts that the curriculum under apartheid perpetuated race, class, gender and ethnic divisions. The curriculum emphasised division rather than commonality. Inequalities existed within the South African system of education. In general, rural schooling for the homeland Blacks was even worse off than urban African education under the Department of Education and Training (DET). There was uneven resource allocation and pedagogy.

Education in the country during the apartheid era was controlled by separate government departments. Before 1994 two educational departments in KZN offered Education to Blacks. These were the Department of Education and Culture (homeland system) and the Department of Education and Training (urban Africans). The type of education offered by these two Departments was considered inferior by most academics, teachers and students. For example, Hartshorne

(1988/9: 96) summarises the deprived context of South African education as follows:

"...the background and context is an inferior, discriminatory, politically driven education system reflecting a political and economic system, the purpose of which is to maintain the domination and privilege of the white sector of society. Just as clear is that poor facilities, large classes, unqualified teachers, unsuitable curricula, disturbed conditions in the school and community, poor socio-economic environment and unsatisfactory examining methods, are all part of the context."

In 1953 amendments in the Bantu system of education began. However, racial separation still continued. Black schools were still under-resourced. To define a typical Black school in South Africa was likely to be difficult, as the classrooms covered a wide spectrum of resource contexts. For example in the Ulundi Region there were many Black schools in which teachers had no access to most of the practical equipment, material resources, physical resources, physical facilities and finances needed to provide adequate education to its learners, particularly in science.

Despite the limited resources for education in Black schools, some of these disadvantaged schools have excelled. Examples of such institutions are the four schools in the Ulundi Region (Hamu, Banzana, Bhokwe and Mangwaana) selected for this study. This is demonstrated by the high pass rates achieved in the physical science matriculation results of these four schools. This suggests that the quality of any school is largely determined not simply on the basis of resources available. The most essential and pertinent indicators of effective schools then may be the

interface between teachers and learners and the outcomes of learning (Dimmocks, 1995), not aggregate resources available.

In 1994 South Africa held its first democratic elections and the African National Congress (ANC) was voted into power. The democratic Government in the country felt the need to integrate the country's various systems of education. To counteract the legacy of the past in which the apartheid curriculum focused on racial separation at the expense of commonality, proposals for the integration of education and training were being made.

In 1995, an official policy on education known as the White Paper on Education and Training (WPET) was implemented to offer guidelines on post -apartheid education policy. The WPET called for an integrated approach to education and training. A single, unified and non-racial system of education was therefore implemented. Policy for such a system was created through Commissions, Green Papers, White Papers and legislation (Government Report to the Nation, 1998). Together with the integration of education and training, the WPET highlighted the establishment of a system of life long learning, organised in terms of the National Qualifications Framework (NQF). The NQF attempts to increase learning opportunities and eradicate potential hindrances to learning for all South African citizens, from school students to out-of-school youth and children; to adults, employed and unemployed (Christie, 1996).

It must be emphasised that the legacies of inequality inherited in Black schools during the apartheid times still remain. The consequences of this

gap are reflected in the poor matriculation achievements of the current educational system. A newspaper report endorses this by stating that "we have had 20 months of post-election education and the matriculation results are worse than ever, described as a shock fall" (Rees, 1996. Appendix A1). Calitz, an executive officer of the South African Certification Council (SAFCERT), confirms this. According to Calitz (1998), the matriculation results in 1996 and 1997 are lower than in 1995 and describes it as the continuation of a trend which started in the 1980s (Appendix A2). Attempts to transform the legacies of the past were a major concern of the 1995 WPET, yet some elements of it remain as it has been argued. Other forms of transformation have taken place in the South African system of education after the post-apartheid elections in 1994. These are continuous assessment and outcomes-based education. Each will be discussed briefly to give insight to the way in which these policies were intended to make schools more effective.

1.2.1 CONTINUOUS ASSESSMENT

In 1996 the Ministry of Education introduced continuous assessment into schools. Continuous assessment is a system of ongoing learner evaluation from the beginning of an instructional programme to the end of the programme. This system does not consist only of a series of tests given under examination conditions. Instead, a variety of assessment techniques and criteria are used. Continuous assessment includes written exercises, project work, general observations, class discussions, homework and tests. In continuous assessment therefore, the learning tasks and activities on which students are evaluated are varied.

I observed that continuous assessment did not work effectively in the majority of the schools in the Ulundi Region. This is because the system of assessment required a good deal of record-keeping and repeated assessment of pupils' performance. It meant there was more work for the teachers. Teachers had to construct tests and do other forms of assessments mostly on their own. This adjustment however was difficult for the majority of teachers.

1.2.2 OUTCOMES BASED EDUCATION

The country's system of education has been in a continuous process of changing. In 1995, the Department of Education embarked on a major curriculum reform. The goal of the review was to phase in, with effect from 1998, a new curriculum, which is based on life long learning for all South Africans (Jansen and Christie, 1999). This new curriculum is to effect a shift from one that is content-based to one that is based on learning outcomes. In 1998, the National Department of Education implemented what is now called Curriculum 2005.

Curriculum 2005 was implemented in all Grade 1 classrooms in January 1998. In this "new" approach, learners are encouraged to be critical thinkers in terms of reasoning and action (Bengu, 1997). Classroom activities under the new curriculum approach tend to be learner-centred while teachers become facilitators. However, this curriculum did not directly affect high schools as yet and therefore had no impact on the schools in this study.

1.3 SITUATION FOUND IN THE ULUNDI REGION

In the Ulundi Region, formerly under the KwaZulu Natal homeland, the majority of the schools are under-resourced in terms of material resources, infrastructure, pedagogical content knowledge and finance (Human Sciences Research Council, 1998). This has been evidenced through personal observation and anecdotal statements from other teachers in most of the schools in the Ulundi Region. At the basic level, problems are encountered by both teachers and pupils as far as the teaching and learning of science is concerned. Prominent among these problems are:

1.3.1 GENERAL SHORTAGE OF ACADEMICALLY QUALIFIED TEACHERS

There are not enough teachers in the rural areas and also not enough teachers are produced from the Teacher Training Institutions to handle science. According to Taylor and Vinjevold (1999), recent research conducted in South Africa confirms that there seems to be an over supply of non-science teachers for grade 12 classrooms. These non-science teachers are seen as contributing to a low teacher-pupil ratio (Taylor and Vinjevold, 1999), the reason being that the apartheid system of education neglected the teaching of science coupled with the lackadaisical attitude of students towards science. Yoloye (1989) supports this by saying that in many African countries there are not enough science teachers in their secondary schools. The end result is that teachers who never trained as science teachers are compelled to teach science (Yoloye,1989).

1.3.2 LACK OF SUPPLIES AND TEACHING AND LEARNING MATERIALS

The Department of Education regards adequate supply of learning support materials as essential to the effective running of an education system and asserts that these materials should form an "integral part of curriculum development" and a "means of promoting both good teaching and learning" (Department of Education 1998: 1)

Although the Department of Education calls for the use of "learning support materials" schools are not receiving the materials needed (Taylor and Vinjevold, 1999). Over the years the authorities have not been able to maintain, let alone increase the supplies of materials (consumable and non-consumable) to schools in the Ulundi Region. The unavailability of materials for practical work, for example, causes the majority of teachers to depend only on theoretical teaching, that is, to the exclusion of experiments and other practicals.

1.3.3 POOR TEACHING METHODS

Most of the teachers especially those newly recruited from the colleges lack sufficient subject matter knowledge and skills to handle science, that is, most of them have a very weak background in science. (Taylor and Vinjevold, 1999) highlight that teachers' poor grasp of content knowledge in subjects, like mathematics and science, act as a major inhibition to the teaching and learning of these subjects, and is a general problem in South Africa. In the Ulundi Region many of the teachers use the lecture method instead of the activity approach where a greater amount of practical work is required. More so, the way science is taught is misleading, which is known to have been from the foundation level,

that is, at the basic education level. Here the emphasis is often placed on "rote" learning about scientific discoveries, giving the learner a distorted view of the nature of science.

1.3.4 NON-AVAILABILITY OF TEXTBOOKS

In most of the secondary schools in the region, of which Hamu, Banzana, Bhokwe and Mangwazana are no exception, there are no science textbooks and even if there are, they are locked up in the offices and are only supplied to pupils during the science periods. The only textbook which sometimes may be available is used by the classroom teacher.

1.3.5 PUPILS INABILITY TO COMMUNICATE IN ENGLISH

Considerable difficulty in reading, understanding and writing, English poses a problem as far as teaching and learning of science is concerned. Langham (1993) asserts that pupils' level of language competence is so poor that textbooks are difficult for them to read, and this has led to a heavy reliance on rote learning and made pupils dependent on teachers for what they learn.

As is known, language competence is crucial in communication. In the teaching and learning of science, the English language is the medium of instruction. It is important to note that the language of science is a second or third language to most learners. For example, at the school where the researcher teaches (Falaza High), all the students are Black and the medium of instruction is English. This makes the learning of science harder for learners in the school as their home language is Zulu. Robin and McGregor (1992) support this assertion. These writers comment that language policy in education tends, universally to be an emotive issue.

They further comment that because the choice of language as an educational medium and what languages are promoted affects the life chances of people. Therefore native speakers of the medium of instruction are clearly at an advantage in the teaching and learning process.

1.3.6 LACK OF FURNITURE

In most schools there is not enough furniture. For example pupils at Banzana, Bhokwe and Mangwazana are compelled to share seats and pupils become uncomfortable and there is usually less concentration on the lessons and this affects the learning of the lesson.

1.3.7 THE WAY SCIENCE IS TAUGHT IN ULUNDI SCHOOLS

The problems often encountered in the teaching and learning situation in the majority of South African schools is generally described in terms of teacher-centredness, pupil passivity and rote learning (Taylor and Vinjevold,1999). School science is not currently presented as a way of viewing nature in most classrooms. In most South African schools, science is taught in the Western way and Africans (non-Western) learners are made to accept the teaching of science in the way it is presented. In science classrooms in the Ulundi area, science is taught through the didactic approach. This approach assumes that the teacher knows everything and that the learner is almost blank. Accordingly, the teacher imparts his knowledge merely by lecturing. This is to say, the teacher talks or addresses the students by means of reading his notes.

It must be emphasised that people have different views about science. For example, people in India may view science as a European science.

My teaching experience in science over the past six (6) years in the Ulundi Region has made him believe that only the Western view of science is recognised as school science, a situation evidenced by Jegede (1995). According to Jegede (1995), the Western view of science seems to gain superiority over other means of studying science and there is no recognition of other different world views.

Everyday life situations influence learning (Taylor and Vinjevold, 1999)) These writers recognise the value of everyday knowledge. They argue that it is crucial in defining the identity of individuals and for building self-confidence of citizens and also respect the differences exhibited by others. In addition, they comment that relating everyday experiences and school knowledge provides important pedagogical tools for inducting learners into the art of formal discourse, and for the practical application of formal knowledge to problems in the real word. However, in the majority of the classrooms in the Ulundi Region the teaching of science is not linked to everyday experiences of learners but rather on Western practices. A discussion on the topic "rainbow formation under light" will give a portrait of the way science is taught.

In the majority of Ulundi classrooms the topic "rainbow" is a body of facts that is not debatable. The teaching of the topic is usually textbook bound. Thus, textbooks are followed. It must be stressed that in the teaching of science in these classrooms (Ulundi area), teachers try to avoid laboratory activities. Allsop (1991, P 33) endorses this situation in rural schools. According to Allsop, in most rural schools practical science does not happen. He comments that most teachers have a

personally limited background in practical science and only slight confidence in teaching methods.

In the Ulundi area, when most teachers conduct experiments they rely on the instructions in the textbooks. For example, in explaining rainbow phenomenon, the Western explanation is due to the refraction of water droplets in the atmosphere. Hence in explaining a rainbow formation to students the textbook explanations are taken as the given.

To enrich the teaching of science in classrooms requires the linkage of the environment with what learners know already for change to happen (Taylor and Vinjevold,1999). The rainbow phenomenon could be taught better by making use of diagrams to give background information of the subject matter. For example, learners can start by drawing a rainbow on sheets of paper. These drawings could be pasted on cardboard in classrooms and allow learners to discuss their drawings. Alternatively, learners can make their own rainbow using a hose-pipe and sunlight. This could be achieved when the open-end or outlet of the hose-pipe is partially closed with one finger for the water to sprinkle out. If this is carried out in the presence of sunlight, a rainbow is formed. Opportunities must be given to learners to make their own ideas through diversity of thought; use of learners own language; awareness of ideas and clarification of ideas. In this way we can encourage students to bring together and integrate ideas.

1.4 PURPOSE OF THE STUDY

The purpose of this research is to explain why some schools with limited resources achieve good science results at matriculation level in the

Ulundi Region of the KwaZulu Natal province of South Africa. In South Africa, the matriculation results receive much public attention. According to Henning (1998, Appendix A3), to some people the examinations of South Africa have been the climax of 12 years of substantial, acceptable schooling, but to the majority they epitomise an irrelevant system dominated by gross disparity of provision. The failure rate in the sciences (matriculation) has been enormous over the past years in under-resourced environments. The reasons for the disaster are more complex, far reaching but there is no reason to be entirely pessimistic.

I have taught physical science for the past six (6) years in the Ulundi Region and have observed that despite the lack of resources in most schools, some schools still achieve good science results at matriculation level. For example, Bhokwe high school obtained 100% pass rate in Physical Science for the 1998 matriculation examinations. This is evident from the statistics at the Nongoma circuit office. Therefore, it has been decided to investigate what factors explain the high level of achievement in science in schools with limited resources.

1.5 AUDIENCE

The findings of this research will be useful to:

1. Educators of science in schools with limited resources to enable them to understand why such schools (under-resourced) perform better and what lessons can be learned from such schools.
2. Subject advisers as information to assist science educators to improve their results, especially in under-resourced schools.

3. Science Teacher Educators to know what could be done to prepare science teachers for successfully improving science results (in under-resourced schools).
4. Science education research in deepening our understanding of effectiveness in science classrooms in under-resourced environments.

1.6 RESEARCH INSTRUMENTS USED IN THE STUDY (Appendix A4)

The instruments used for the research were semi-structured questionnaires, interview schedules and classroom observational schedules (Appendices A4.1, A4.2 and A4.3 respectively).

1.7 THE SAMPLE

What follows is a detailed profile of the schools being researched to allow a comparison and to give a portrait of what the teaching of science is likely to be in these schools. The schools chosen for this study are located in the rural areas in the Ulundi Region of KZN (Appendix A5). These schools have limited science equipment, consumable materials and material resources. Also, these schools have no electricity. These schools draw their students mostly from their surrounding neighbourhoods or communities. These schools were chosen because they all attained above average matriculation results in science, are close to the school where I teach, and I have access to these schools. Also, I have colleagues in these schools who were ready to assist in the research project.

1.7.1 MAMU HIGH SCHOOL

The school is in a rural area where transport is usually unavailable. It is located in a forest area near Vryheid. The school is nicely built and fenced and has sufficient classrooms. There is no staff accommodation except for the principal's bungalow. Teachers stay in dilapidated houses in the community. Students walk several kilometres (an average of about 3 kilometres) between home and school. Hamu High has 14 teachers with 650 students.

The school has a well-established positive ethos, with stable staff, agreed codes of conduct and good school policies. Material resources such as textbooks and other printed materials in the form of pamphlets are very few in the school for the teaching of science. In terms of laboratory equipment and consumable materials, the school is very under-resourced and so, the laboratory is not stocked. For example, there are no Bunsen burners, chemical or beam balances, chemicals and so forth.

Analysis of the 1998 physical science results at Hamu indicates that out of twenty (20) students who wrote the matriculation examination (physical science) 17 passed (85% pass rate) with two (2) A's at Standard Grade level. This represents an average of 10%. Also, one (1) student obtained symbol B at Higher Grade (5% on the average) and 3 C's, representing an average of 15% at Standard Grade level. This is evidenced from the statistics at Vryheid Education office.

1.7.2 BANZANA HIGH SCHOOL

The school is thirty-five kilometres away from the town of Nongoma. At Banzana, taking into consideration the size of pupil population, the

physical environment and resources do not match the number of classrooms and are inadequate to cater for pupils. By South African standards it is an overcrowded school. Provision of textbooks is also inadequate. Laboratory equipment, consumable and non-consumable materials are not in the school to engage pupils in practical work as the school has no science laboratory. The school also has no library facilities for pupils to use.

Banzana has a population of approximately 800 students and 23 teachers. Despite the problems facing the school, a culture of learning is evident. In 1998 Banzana achieved 69% pass rate in physical science. Generally, teacher morale is high and learner and teacher absenteeism is low. Banzana High School has no teacher accommodation. Most of the teachers commute daily from Nongoma.

1.7.3 MANGWAZANA HIGH SCHOOL

Mangwazana High school is located in the mountainous area of the Ubombo district. It has a staff of 15 and just under 700 learners. The school has developed a very strong collaborative approach among the teaching staff such that after the normal school hours, Grade 12 teachers continue to offer extra classes to their students on an agreed number of days in a week. At Mangwazana High, students have positive attitudes towards learning. This positive attitude has created a situation for effective teaching to emerge. Mangwazana obtained 96% pass rate in physical science for the 1998 matriculation examination. Mangwazana High has poor building facilities. The school has no science laboratory and so practical work does not take place in the school.

1.7.4 BHOKWE HIGH SCHOOL

Bhokwe High school is located at a distance of twenty (20) kilometres from Nongoma. It is a rural school void of basic infrastructure. A school library, laboratory and staff apartments are all absent. The school enrolment as at the start of 1999 academic year was about five hundred learners with fourteen teaching staff. Despite all the odds, such as poor infrastructure (water supply, electricity, teaching aids inter alia), the staff has been able to maintain a sound academic environment. This is epitomised by the recent academic excellence of the school regarding the pupils' matriculation results. This school (Bhokwe High) achieved 100% pass rate from 18 science students for the 1998 matriculation examination. Source of this information was obtained from the Nongoma circuit office.

1.8 CRITICAL QUESTIONS

This research investigates two critical questions.

1. What are the factors that explain successful science performance in under-resourced schools?
2. What kinds of instructional strategies are used by successful science teachers in under-resourced schools?

1.9 LIMITATIONS OF THE STUDY

This study is limited in that the sample is restricted to four schools in the Ulundi Region and also because the study concerns itself with physical science only. Schools were also selected on the basis of easy accessibility and readiness of teachers to co-operate in the research endeavour. It is therefore difficult to generalise the findings since I have not analysed

similar trends in other schools. Again, the study is limited to standard ten (10) physical science only.

I have also not given any indication of how the schools performed in 1996 and 1997 because the analysis of these results could not be traced at the Nongoma circuit office. This also, is a limitation in the study.

As far as the quantitative aspect of the research is concerned, there will be some limitations in the numerical presentation in the complexity of human behaviour in educational research as suggested by Solutes (1990). The point being emphasised is that since the research deals with psychological dimensions in human beings, the quantitative aspects were to some extent difficult to express.

The study is also limited by personal subjectivity. This is due the fact that in the observational schedule, the observations are likely to come out of what the observer chose to see and chose to observe. The precautions I took to manage this limitation was to involve co-observers.

1.10 VALIDITY OF THE STUDY

The validity of the study was strengthened by:

(a) piloting a questionnaire on a small group in the school where the researcher is teaching. However, no changes were made on the final draft of the questionnaire after piloting. The goal of this was to indicate whether the students understood the questions and at the same time if it was going to generate the kind of information expected;

(b) finding an expert to document analysis of data captured, interpreting the data in his preferred ways for a consistent trend or pattern to develop;

(c) submitting the questionnaire and interview questions to my supervisors for their comments which resulted in changes being made; and

(d) triangulating both the research instruments and the sources of data captured. In other words, the quantitative data captured from administering student's questionnaires were complemented by qualitative information obtained from teacher interviews and classroom observations. The study therefore required more than one method of collecting data questionnaires, semi-structured interviews and observational schedules.

1.11 CONCLUSION

This Chapter outlined the motivation for the study, purpose and rationale of the research, the critical questions, the limitations and validity of the study. Attention was also focused on the historical background and educational reforms that have taken place in the country since the post-apartheid elections. Again, a brief description of the researched schools in terms geographic position, teacher-pupil ratios, relationships and infrastructural resources was discussed.

The next chapter will focus on the literature survey and will present a critical review of the characteristics of effective schools. At the same time, definitional issues on effectiveness will be discussed.

CHAPTER 2

WHAT DO WE KNOW ABOUT EFFECTIVE SCHOOLS? A CRITICAL REVIEW OF THE LITERATURE

2.1 INTRODUCTION

Literature on "effective schools" in South Africa is limited and has not been easy to locate. Jansen (1995, p.193) comments that "Southern African states have not been immune to the effective schools research agenda." South Africa, for a long time did not participate in effective schools research. South Africa recently involved herself in studies on school effectiveness and educational efficiency (Jansen,1995). Abundant literature on school effectiveness is available in studies done in the United States of America (U.S.A), United Kingdom (U.K) and other countries.

Effective schools literature pre-supposes that the achievement of good science results hinges on resource availability. According to Fabiano (1995), science education will not produce the desired results unless the education system is adequately resourced. Effective schools literature again indicates that "effective schools" are designed to and organised to support effective teaching and learning. Such teaching and learning engagements in schools have an ethos characterised by expectation, collaboration and innovativeness (Hopkins, 1995). Further more, most of the readings on effective schools have shown that there are several variables in the learning environment that relate to student's achievement. Factors ranging from leadership (Edmonds, 1979; Hopkins and Ainscow,1993 and Williams, 1983), learners' background (Coleman, Campbell, Hobson, McPartland, Mood, Weinfeld and York (1966) ;

Jencks, Smith, Ackland, Bane, Cohen, Gintis, Heyns and Michelson (1972) ; Glesman and Biniaminov (19981) ; Lewin (1980), staff development (Reynolds, Bollen, Creemers, and Hopkins, 1996) and effective instruction in the classroom (Creemers, 1996) to teacher activities, may influence student's achievement.

This chapter aims to present a review of the characteristics of effective schools. The chapter again, clarifies definitional issues of the term "effectiveness" and identifies strategies in effective schools.

2.2 IMPLICATIONS OF LITERATURE REVIEW

In this research, in-depth study of the relevant sources of information was done to get a clear insight into the nature of the problem being researched. Various issues of importance to the study were obtained from the review of existing literature on effective schools. Documentation analysis of this study includes a number of journals based on science education, research articles in science education and books on effective schools.

2.3 RELEVANT READINGS TOWARDS THIS STUDY

A number of reading materials were found to be relevant to this study.
The readings listed in the bibliography suggest how effective science teaching is taught, particularly in under-resourced situations. I will briefly highlight what some of the literature say or suggest.

Pomeroy (1994, p53) suggests a number of useful strategies for teaching science. He highlights the localisation of the context of science curriculum which Jegede (1995,p115) interprets as the linkage of

environment with what learners already know. The point the authors wish to arrive at is that learning is influenced positively by relating teaching to the everyday life situation. This is to say, everyday life situations need to be used to illustrate and introduce scientific concepts. The relevance of this approach is students' are more likely to see science as a less alien pursuit (Pomeroy, 1994). However, the teaching of science in the majority of schools in the Ulundi Region is not based on everyday experiences of the learner but rather on Western methodology. This is to say, Western methods and examples are used to illustrate and introduce scientific concepts. For example, chemistry can be taught effectively by linking some aspects to local culture. To cite an example, learners can be introduced effectively to the preparation of alcohol through the local processes of fermentation and boiling of sorghum instead of starting with laboratory or industrial processes. There is, therefore, a need to integrate science curriculum and local environment and make use of everyday situations to illustrate and introduce scientific concepts by relating them to reality.

Pomeroy (1994), also comments on appropriate teaching strategies for diverse teaching. He suggests the utilisation of strategies such as co-operative groups. Sharan and Sharan (1994) support this teaching strategy by saying that, "Co-operative learning methods provide an alternative to other methods of teaching. They (educators) strive to create a setting responsive to students' questions and productions and offer a variety of ways of increasing student participation in the learning process". The value of this teaching approach is that it minimises the traditional way of teaching science and modifies the learning styles of others (Sharah and Sharan, 1994). At the same time, all students take

responsibility and active engagement of their own learning. Sharan (1995) also recognises the need for co-operative procedures in class to help students. Sharan (1995) argues that in this procedure, students learn to help one another, share ideas and, at the same time, develop self-direction and responsibility for their learning.

Responses from data collected through teacher interviews from the four schools being researched in the Ulundi Region show that co-operation is necessary in class since students share ideas and solve questions quickly, and there is the spirit of working together.

Pomeroy (1994) again argues that the studying of science in "folk knowledge" or "native technologies" is a useful approach to science teaching because, students relate more easily to science as the focus of enquiry and is related to their own cultural knowledge. This approach to science teaching is likely to increase student's interest in science as it fosters more positive attitudes towards science.

Mastery learning strategy of science teaching has also been stressed by Postlethwaite (1993) to cater for all ability groups. According to Postlethwaite (1993) mastery learning involves the division of a course content into units and for each unit, the criteria for mastery should be made clear. Each unit is planned to cater for what the learners as a group know and can do to all ability levels. As far as mastery learning is concerned, a diagnostic assessment at the end of every unit is useful to see if each learner has achieved the unit objectives. The relevance of this assessment is that on the basis of the assessment findings, students who have not attained the unit objectives are assisted. The only setback

envisaged as far as mastery learning is concerned is that it is time consuming. That is to say, more time is needed for each student to achieve the key objectives of the unit. In practice therefore, a teacher is more likely to decide to move the class on to a final summative assessment of the unit and then to the next unit (Postlethwaite, 1993).

Mastery learning teaching sequence takes longer to teach than the teaching situation under normal conventional instruction. For this reason, mastery learning does not take place in classrooms in the Ulundi Region since the syllabus in use is too broad and it is expected that each aspect of it should be covered. Onwu in Taylor and Vinjevold (1999) evidence this situation. According to these writers, research conducted on the use of learning materials in Grade 12 science classes in the Northern Province indicates that the matriculation science syllabuses are inordinately long and there is insufficient time to cover the syllabus adequately.

Postlethwaite (1993) further argues that variation in whole-class teaching as a strategy can assist learners. This is to say, a range of teaching approaches, and a range of levels of treatment that suits the need of individuals in the classroom, helps to address learners' differences. For example, by repeating the key aspects of a topic in different ways and in different styles and at different levels, all ability groups are catered for because each learner could tune into an aspect of the teaching that suits him or her. To add on this, flexible learning as a useful teaching strategy of science to assist students' in their learning needs as individuals through flexible management and through the use of learning activities, environments etc., has again been suggested by Postlethwaite (1993).

Dimmock (1995, p13) endorses this teaching strategy. He comments that because students learn through a variety of teaching-learning strategies, the supporting organisational structure needs to be flexible. By flexibility in this context, the authors (Postlethwaite, 1993; Dimmock, 1995) mean grouping of pupils and teachers. For example, each student has his or her individual learning style. Some students prefer working in groups, in pairs, in small groups, in singles and in large groups. Opportunities must therefore be given to learners in class to allow them to study in ways they like. All the four teachers from the researched schools highly endorse flexibility in groupings. They argue that flexibility in the curriculum influences pupils learning effectively. They cite examples that pupils learn best from their peers through grouping.

Concerning groupings of teachers, a group of about four teachers could team up. Teachers in this group can share ideas and visit one another class to assist in teaching. The advantage of flexibility is that it meets the learning needs of individuals through flexible management and use of a range of learning activities and environments (Postlethwaite,1993). One thing that is not valued about flexible learning is that, although it does not prevent periods of whole-class teaching, however some versions of the approach imply that students progress at different rates over long periods of time (Postlethwaite,1993). This therefore makes it harder for the teacher to find topics for whole-class teaching that appeal to all students at the same time.

Scott (1987) and Holding (1998 p83) espouse the constructivist view of learning and teaching science. The constructivist approach of teaching science according to these authors involves finding out what students'

current views are and helping to focus construction of new knowledge towards ideas generally held in the scientific community. The value of this teaching strategy is that, where it is applied learners do not become passive since each learner contributes ideas and takes responsibility of his or her own learning.

The literature also shows that effective assessment procedures can effectively influence the learning of students. Assessment will then form part of the framework of this study since the nature of assessment techniques has a greater influence on pupil's performance. Reid and Hudson (1989) define assessment as a process of obtaining knowledge about pupils developing knowledge, abilities, skills and attitudes. In the context of this study the term assessment means the measurement and evaluation of an individual's potential and actual performance. The measurement aspect of assessment is the collection of quantitative and qualitative information through the use of instruments such as tests, homework and class exercises.

The evaluation aspect involves making judgements regarding the status of the individual relative to some standards, expectations, other individuals or groups of individuals and instructional programmes themselves. In terms of education, assessment serves many purposes. To pupils, it assists them to determine the progress they are making to achieve their goals, identify their weaknesses and thereby enabling them to modify their approaches accordingly. It helps teachers to assess instructional procedures, identify areas that require improvements and the achievements of their pupils.

Grayson (1994) comments that assessment procedures can effectively influence the learning of students positively if the following criteria are met; the objectives being made clear to both the assessor and pupils; making what will be assessed clear to both assessor and pupils and finally the assessor specifying the assessment criteria clearly to pupils. Candy, Crebert and O'Leary (1994) on the other hand suggest the encouragement of self-and peer assessment as an effective procedure to be employed to influence the learning of pupils. At the same time, Candy, Crebert and O'Leary (1994) further stress that assessment procedures would influence the learning of pupils if it tests different types of skills. As far as it is concerned, writers Rolfe and McPherson (1995) Grayson (1994) and Candy, Crebert and O'Leary (1994) agree on regular systematic feedback as an effective assessment procedure that can influence the learning of pupils.

Grayson (1994), Rolfe and McPherson (1995) and Candy, Crebert and O'Leary (1994) again agree on a close link in the way assessments are made. In making assessment effective, there should be links between classroom teaching and formative assessments. Summative assessments should also have a close bearing on formative assessment. That is to say, there should be some interconnectedness between formative and summative assessments. To provide this link, teachers need to ensure that what is taught in the classroom should not differ very much from the assessments given to pupils. Rolfe and McPherson (1995) again emphasise that in assessing pupils, teachers should ensure that conditions under which assessment is done are conducive to pupils and should be tension free. Teachers therefore need to encourage rather than threaten pupils anytime they administer tests.

Assessment policy in Ulundi schools is that pupils are given enough class exercises, homework and they write monthly tests. Besides this, pupils write quarterly tests at the end of each quarter and a promotion examination at the end of the year. It has been observed by the writer that assessing students regularly, forces them to make continuous effort throughout the instructional programme since each assessment counts towards a final grading mark. This is to say, because assessment is based on cumulative record of student's work, the learner tries not to pull out. Assessment procedures in the Ulundi Region therefore motivate learners to maximise their learning. Teachers in the four researched schools emphasised the need for a close link between classroom teaching and assessment. The writers Grayson (1994); Rolfe and McPherson (1995) and Candy, Crebert and O'Leary (1994) all endorse this close link between classroom teaching and the way assessments are made. Each school in the Ulundi area has its assessment policy and the onus rests on each teacher to assess his or her pupils regularly. For example in the four schools being researched (Hamu, Bhokwe, Banzana and Mangwazana), the teachers are obliged to administer at least one test in a month. Teachers in the majority of the schools in the area believe that regular assessment is the only way to go if student's learning is to be effectively enhanced. Embarking on this strategy enables students to identify their weaknesses and strengths, and teachers to furnish advice on how best to proceed.

2.4 DEFINITIONAL ISSSUES OF EFFECTIVENESS

Various terms are used to describe the output of education (Creemers; 1994). For example the effectiveness of education, the effects of

education, the instructional effectiveness and educational effectiveness (Creemers, 1994). According to Creemers (1994), effectiveness is used to express different notions. Creemers (1994) cites the example that educational effectiveness is defined as the output of the total educational system. This same term is used to describe the effects of education within a specified classroom (Creemers, 1994). The term "effectiveness" therefore has to be intimately associated with education; and it is in this respect that the term is of interest as it pertains to education, the term "effectiveness" has never had a concise definition. At various times, researchers on effective schools come with definitions that seem to satisfy current views of the term. The term "effectiveness" therefore leads to confusion as it is simultaneously used to describe effects and efficiency. "Effectiveness" used in this study therefore needs to be defined clearly.

Dimmock (1995, p9) defines "effectiveness" as the acquisition of knowledge, understanding or skills, in ways that foster assimilation and accumulation with learning and enduring for as long as it is found relevant by learners. According to Rees (1996), "effectiveness" means having the desired effect. Rees (1996) comments further that effective schooling means that pupils receive a specified curriculum such that at the end of their schooling they are able to demonstrate knowledge of the curriculum. In the South African context this implies passing matriculation.

"Effectiveness" in the context of this study may be defined as the ability or capacity of a school to realise its goals. Thus, "effectiveness" embodied in this study relates to a high pass rate at the matriculation

level. The reason for using the matriculation results as a measure of knowledge is that a good matriculation pass results in the minimum requirement to gain access to a South African college or for any degree at a university, providing learners with a wide range of opportunities after school.

2.5 CONCEPTUAL FRAMEWORK

The conceptual framework of this study is built from the "effective schools literature". This body of literature suggests that multiple factors contribute to school effectiveness. Effective schools research focuses on factors determining learner's achievement. Edmonds (1979) and Ally and Bacon (1989) have identified the following characteristics to be associated with effective schools.

*Good leadership.

*Conducive environment for learning.

*High expectation for students' achievement.

*Clear instructional objectives for monitoring students' performance.

*Acquisition of basic skills.

These factors feature prominently in overseas literature. It must be mentioned that a lot of these factors seem to apply to schools in the Ulundi Region (example, the four researched schools) and therefore realistic in the South African context. But other factors like adequate resources, good parent involvement, small class sizes etc. are lacking in the majority of the schools in the Ulundi Region.

Reynolds, Bollen, Creemers, Hopkins and Stoll (1996) base the conceptualisation of effective schools on conditions within schools that can sustain the teaching-learning process. Hopkins and Ainscow (1993)

also have identified a number of conditions underpinning effective schools. Broadly stated these conditions are:

*Staff development

*Involvement

*Leadership

*Co-ordination

*Enquiry and reflection

*Collaborative planning

Yet there are other researchers that list other factors including:

*Staff appraisal

*School discipline

*Co-operating with parents

*Team building

*Learners background

*Authentic relationships

*Teachers' repertoire

*Rules and boundaries

*Reflection on teaching

2.6 EFFECTIVE SCHOOLS

The issue of "effective schools "has been a matter of interest and concern in the current educational cycle. At the heart of these schools is effective learning. Effective learning does not come about accidentally. It is the result of effective learning situation created by skilful teachers (Hopkins, 1995). Schools in which students progress faster than one might expect as a result of prior learning profiles appear to share similar characteristics.

Over the years, researchers on school effectiveness have examined the quality of schooling in an attempt to explain why some schools are more effective than others and the characteristics that are commonly shared in effective schools (Reynolds, 1989a; Cotton, 1990; Sammons, 1993). Several factors underpin "effective learning". Learning is more effective when it is goal-directed. It is student's outcome that provides goal direction for learning. In effective schools, learning and the individual learner are made the centre-piece of all that takes place in classrooms. At the same time, teaching focuses on learning and teaching for understanding; a balance and a variety of teaching strategies are achieved, a combination of methods from didactic and expository to constructivist as suggested by (Dimmock, 1995).

2.6.1 CHARACTERISTICS OF EFFECTIVE SCHOOLS

Various issues of importance to this study have been obtained from the review of existing literature on effective schools. As it has been said earlier, factors including leadership, management, learner's background, effective instructions monitoring of student's performance and staff development are some of the characteristics of effective schools. It should be noted that not all the factors stated above are applicable in the schools researched. A brief description on some of the essential characteristics of effective schools will be discussed.

2.6.1.1 LEADERSHIP

The literature has shown that the quality of any school, to some larger extent, is determined by effective leadership. This has been evidenced by Williams (1983). Leadership is one of the most essential factors contributing to school effectiveness. Williams (1983) points out that the

leadership style of a principal has a direct impact on the performance of a school, its staff and pupils. Thus, the style a principal employs to execute his or her duties are more likely to affect classroom activities and how students' learning is influenced.

Effective schools are often characterised by participation of the principal in the entire instructional program, as suggested by the writers Benjamin (1981) and Austin (1979), through supervising and evaluating instruction, co-ordinating the curriculum, monitoring learners' progress, protecting instructional time and promoting instructional improvement. However, this does not happen in the researched schools. A greater number of students who participated in this study disagreed that their learning is being influenced effectively by the leadership styles of their principal. I need to emphasise that I do not concur totally on this claim made by the majority of the students since it is the teachers only who would really know how important the role of their principal is. The students may know that only to a lesser extent.

2.6.1.2 MANAGEMENT

Management is a crucial factor in the effective schools. Fraser and Tobin (1989) assert that a common characteristic of exemplary science teachers is that they manage their classrooms effectively by actively monitoring student behaviour. In terms of management, effective schools place much emphasis on how planning, school discipline, parent involvement and school time management jointly contribute positively towards school achievement. Planning, as suggested by Squelch and Lemmer (1994), is a necessary managerial task. Leaders in effective schools embark on developing plans necessary to promote effective teaching and learning.

School discipline is an essential characteristic of effective schools and is crucial in classroom management.

In effective schools, parents are involved in the day-to-day running of the school. Canter and Canter (1991) point out that parent involvement is an essential factor in effective and should occur through out the year. Canter and Canter (1991) suggest that, in dealing with parents, schools need to draw a working plan to be used through out the year. In South Africa, parents are now expected to be effectively involved in the running of schools. In all South African schools, there is a governing body. Members on these governing bodies are involved in decision-making and the smooth running of their school. For example, in the school the researcher teaches (Falaza High), pupils are motivated by parents. There is therefore a drop in delinquency and pupils have positive attitudes towards learning.

Time management is also an essential feature of effective schools. In any school, time is allocated and it is expected that all of it has to be used effectively. Effective use of allocated school time positively influences students' achievement (Knight, 1989). Squelch and Lemmer (1994) argue that effective school time management is associated with high academic achievement.

2.6.1.3 MONITORING STUDENT'S PERFORMANCE

Literature on effective schools suggests that, in effective schools, principals monitor students' progress regularly (Edmond, 1979; Levine, 1982). As it has been said earlier, principals do not monitor students' progress. Nevertheless, principals in these schools frequently pay visits

to the staff room to make sure that teachers do not miss their lessons. This monitoring ensures that teachers perform their duties as expected. In addition to these visits, effective schools monitor students' performance by making sure that all students do their homework and assignments. Teachers interviewed in the researched schools, indicated that students do their homework assignments. Schools that administer homework regularly and ensure that the homework is marked, generally achieve better academic outcomes as suggested by Mackenzie (1983). Homework, according to Coleman, Hoffer and Kilgore (1982), has a positive influence on students' achievement because it allows parents to become involved in the students' academic work.

2.6.1.4 STAFF DEVELOPMENT

The effective schools literature again indicates that schools will not improve unless teachers, individually and collectively, improve their knowledge, skills and attitudes (Reynolds, Bollen, Creemers, Hopkins and Stoll (1996). Staff development is any activity organised by schools to enhance effective teaching behaviour and provide opportunities for teachers to improve and develop their skills. That is, staff development involves any effort made by educational leaders to promote personal and professional growth of staff. In effective schools, staff development programmes in the form of in-service training (INSET) are organised for teachers.

In the Ulundi Region staff development in the form of workshops and INSET are organised for teachers. However, these workshops and INSET are not organised regularly. In any particular year, one or two workshops are organised for teachers in the Ulundi Region. Hofmeyer (1991) who

conducted research on INSET comments that research into homeland INSET reveals a strong interest and faith in INSET as a key strategy for improving the quality of teaching and ultimately the quality of education. However, Hofmeyer's (1991) research reveals that many homeland departments of education did not have an INSET policy, or if they had it, it was merely a plan only for upgrading qualifications.

2.6.1.5 LEARNERS' BACKGROUND

Many schools in South Africa are faced with large numbers of heterogeneous pupils, learners who come from different backgrounds. Robin and Mcgregor (1992) assert that teachers confronted by a heterogeneous classroom will tend to work with the brighter children and pay less attention to the others. In South Africa the problem is compounded because open schools are the exception in an otherwise segregated system (Robin and Mcgregor, 1991, p70-71). But this is not the case in Ulundi. For example, in the four researched schools, pupils are culturally homogenous (Zulu Culture and Tradition).

Effective schools literature also shows that there exist differences among learners in terms of achievement. Coleman, Campbell, Hobson, McPartland, Mood, Weinfeld, and York, 1966; and Jencks, Smith, Acland, Bane,Cohen, Gintis, Heyns and Michelson (1972) attribute this variation to learners' background. At the same time, the authors, Glesman and Biniaminov (1981) argue that those variables including parents educational level, income level and ethnic background influence learners' achievement.

As it has been said earlier, almost all the learners in Ulundi schools have the same cultural background (Zulu Culture and Tradition). However, it must be made clear that this study has not tried to establish whether the nature of learners' background effectively influence their achievement.

2.7 FRAMEWORK OF THE RESEARCH

Developing an effective school is a difficult task. It consists of activities that are carefully planned and provided by schools to meet their goals. These activities may range from monitoring students' performance, staff development, team building to effective instruction. The effective schools approach is therefore involved, complicated and continuous. It therefore becomes imperative to plan and prioritise in order to identify the critical needs of the school and integrate them.

In constructing the framework for this study, I sampled out five (5) of the most recent and important literature on effective schools and selected the most common or highly rated factors to constitute the focus of the research. The framework of this study therefore concerns those factors that correlate with student's achievement with special focus on instructional and management factors at the classroom level and contingent factors of management and organisation at the school level. In clear terms the study is focused on classroom environment, assessment, methodology and effective instruction.

2.7.1 CLASSROOM ENVIRONMENT

Each classroom has a distinct climate that may be relaxed, friendly, co-operative, indecisive, tense or hostile as suggested by Badenhort (1991).

This climate may either stimulate or hinder effective teaching and are likely to influence the manner in which the classroom teacher manages the specific classroom situation. Researchers like Barr and Drebeen (1981) also argue that classroom environmental factors influence students' learning and others see the teacher as an agent of change in the teaching process (Lightfoot, 1983). Other writers on effective schools also comment on some effective ways that seem to promote student achievement. Some of these ways include; opportunity to learn and teacher behaviour (relationship).

For the achievement of educational outcomes to be realised, students should be given some opportunity to learn in order to acquire skills and knowledge. Opportunity for students to learn, therefore, calls for some flexibility in the classroom. It is therefore crucial to design arrangements in ways that give students enough time to work in line with their potential. Owunka (1983) also suggests that the establishment of good relationships in classrooms is essential for effective teaching and learning to emerge. Thus, effective teaching behaviour of a teacher will lead to the acquisition of skills and competencies in learning.

2.7.2 EFFECTIVE INSTRUCTION

Whatever goes on in the classroom has some effect on students. Individual needs vary and sometimes a person needs help in finding his or her own way to satisfactory achievement (Epstein, 1979). In the classroom, the teacher is constantly on the alert to encourage and guide children into neglected or difficult areas of learning and effective instructions will result in the attainment of educational outcomes, mainly students academic outcomes (Creemers, 1996). According to Creemers

(1996), the term "effective instruction" may refer to those factors and variables in instruction that contribute to the attainment of educational outcomes. In other words, effective instructions redress factors and variables in the instructional processes at the classroom level. In the context of this research, effective instruction is a means by which the teacher presents new materials which he or she thinks will lead to the expected outcomes (high pass rate). This includes essential decisions the teacher takes in the course of his or her presentation. In this process (effective instruction), the teacher is expected to present the material for the class in a sequential order.

2.7.3 PEDAGOGY

Pedagogy also plays a vital role in any teaching and learning situation. The method employed by teachers has a significant influence on pupils' learning. There is no one "best method" of teaching nor is there any one method that will suit every occasion. Different objectives, different subject matter, and different types of pupils require different teaching strategies and tactics (Owunka, 1981). The study of this research will again focus on methodology since the method adopted by a teacher may promote or hinder learning. From classroom teaching and learning experience it is observed that pupils have various learning styles ranging from serialism to holism. For this reason, teachers who participated in this study responded positively on the need of variation of teaching methods ranging from demonstration to discovery to engaging and involving all learners. Critical pedagogy then suggests the need to identify the rules and conditions in the classroom that may influence classroom practices. In such a situation, students and teachers together construct meaning of their own knowledge in the teaching and learning

process. In this way the existence of the political nature or power dynamics breaks down in the classroom.

2.7.4 DISCIPLINE

Discipline provides a better atmosphere in which students can learn free from disruption and chaos. School discipline is necessary for the maintenance of order and harmony as suggested by Squelch and Lemmer (1994). The "Grade 12" teacher at Banzana High school strongly believe that discipline is necessary in schools. According to this teacher the results in his school have been good since there is discipline. He stressed that he has taught in different schools in the rural Ulundi Region and has noticed the difference that without discipline the children would not like to learn.

2.8 CONCLUSION

In this chapter, a literature survey was conducted to get an insight into nature of the research. Essential to the chapter are definitional issues, conceptual framework for the study and characteristics of effective schools.

Literature review on effective schools has been of great importance in this study in diverse ways. It provided a scientific base for the planning, an understanding of various concepts involved in the study and an indication of suitable methods for data collection and analysis. In this sense, the literature review enabled me to focus on some of the common factors from past research that explain high students' achievement.

It should be emphasised that the development of any of the factors of the characteristics of effective schools alone or singly would not lead to school effectiveness. For schools to be effective, the factors discussed under the characteristics of effective schools need to be implemented collectively. The next chapter will discuss the research framework in more detail focusing on selection, the schools (sample), and the research instruments.

CHAPTER 3

RESEARCH DESIGN

3.1 INTRODUCTION

This chapter discusses the research design and methodology. Emphasis will be placed on preparations and arrangements made to gain access to schools, the selection of the schools and the research strategies used for the collection of data.

3.2 SELECTION OF SCHOOLS

The research provides a detailed study of four (4) effective schools in the Ulundi Region, focusing on the interactions within schools and classrooms that explain "effectiveness". The 1998 matriculation results in physical science of the KwaZulu Natal Department of Education which are available for each school in the Nongoma District Education office and Vryheid Education office were used for the selection of the four sample schools. Two schools were selected from the Nongoma area, one from Vryheid area and the other from Ubombo area. Banzana and Bokhowe High schools were the two chosen from Nongoma district. Hamu and Mangwazana High schools were those selected from Vryheid and Ubombo districts respectively. These schools achieved good results in physical science in 1998. Documentation analysis of the matriculation results at the examinations office in Ulundi indicates that Banzana High, Bhokwe High, Hamu High and Mangwazana High schools achieved 69%, 100%, 85% and 96% pass rates in physical science in 1998 respectively. These schools were selected among the few effective schools in the rural areas of Ulundi Region because of the readiness of teachers to participate in the research project. The four schools chosen

are in remote areas with poor resources and physical facilities. They do not have enough classrooms to accommodate the pupils. In addition to this problem, they have no laboratory, equipment and consumable materials.

3.3 GAINING ACCESS TO SCHOOLS

After identifying the schools, I wrote to principals of the four schools to seek permission to conduct the research. (Appendix A6). I made the necessary appointments with the schools to deliver the student questionnaires and to explain the modus operandi. Dates and time were fixed for teacher interviews and classroom observations.

3.4 DATA COLLECTION INSTRUMENTS/METHODS

Instruments for data collection in the research were questionnaires, interviews and observational schedules to answer the critical research questions formulated (Appendices A4.1, A4.2 and A4.3). As it has been said earlier, the questionnaires contained mainly closed-ended questions with a few open-ended questions for students in the four selected schools offering physical science at grade 12 level. The questionnaire required students to indicate with a cross (x) on a four-point scale, ranging from "not at all"; "sometimes"; "many times" to "all the time" the frequencies with which they undertook certain activities in the classroom. There were few rating questions with their responses ranging from "excellent"; "very good"; "good"; "poor" to "very poor". Before students were made to answer the questionnaire, I met these students and explained each of the questions to them. The students were then given the opportunity to take the questionnaires home and return them the next day to their class teacher after answering all the questions.

In the study, the research instruments have their strengths and weaknesses. The value of the student's questionnaire in the study is that it provided a quantified picture of life in the classrooms of the four researched schools as perceived by students to enable comparisons to be made. In other words, it enabled me to measure the frequency counts of specific activities related to the teaching and learning of science in the classrooms of the researched schools. The students' questionnaire had the following drawbacks. Despite the fact that I explained each of the research questions to the respondents, some students still had problems understanding some of the questions because of a few missing items. Hence student non-responses to such questions are likely to have an influence on the research findings.

The interviews were meant for teachers who teach physical science at grade12 level in the four chosen schools. I visited each of the four teachers involved in the research and had direct interviews with them. Each teacher was interviewed for about one hour fifteen minutes and his responses recorded on an audio-tape and transcribed afterwards.

The strength or value of the interview is that it made it possible for me to write down direct quotations from the teachers who were involved in the study and also to probe certain responses. One weakness of the interview was that some teachers were unwilling to be interviewed. They were not prepared for the interview each time the I visited them because they thought that the interview was a means of assessing them. However, this did not prevent me from getting information from these teachers. I finally got the information after convincing them that, the information are

needed for research purpose only and that all responses will be treated and kept confidential.

Concerning the classroom observations, I observed each school involved in the research for two days and involved some teachers in each of the schools as participant observers for three more days. Thus, observation was done in each of the participating schools for five consecutive days and was focused on the same topic. Observations in the classroom were recorded as field notes immediately after each observation.

The value or strength of this classroom observation was to give me an actual view of classroom procedures or what takes place in the classroom under normal situations. It must be emphasised that classroom observations have their weaknesses. This is because what one sees is mediated. Hence in the research, teachers who were involved as "participant observers" are likely to see things differently since observations are influenced by own experiences. There is therefore the possibility that in the study there will be variation in the interpretations of observations in the classroom.

3.5 CRITICAL QUESTION 1

What are the factors that explain successful science performance in under-resourced schools?

I looked at this question from conditions in the school and community that tend to influence classroom practices. I established the nature of organisation in the school and classroom environment as part of the research to find out if they do contribute to a high level of achievement

in science. This was achieved through teacher interviews and students' questionnaires.

3.5.1 INTERVIEWS

I interviewed all grade 12 science teachers in each of the four schools together with the Head of Department (HOD) for science. The interviews consisted of general questions followed by some prompting questions (Appendix A4.2). The prompting questions were only used as needed to get the interviewee to elaborate further if the answers provided were not adequate. The interviews I had with the teachers were semi-structured. The reason for using a semi-structured interview was to make it possible to probe certain responses or ask additional questions to enable me to get relevant information. The responses from the teachers involved were recorded on audio-tape and later transcribed. The goal for conducting these interviews was to find from these teachers in an under-resourced environment what they believed constituted the underlying factors explaining good science results in their schools.

3.5.2 QUESTIONNAIRE

I also designed questionnaires for grade 12 learners. Each grade 12 learner in the four schools was given a questionnaire to answer the questions about what they feel contributes to achievement in science in schools. The questions were mainly closed-ended and respondents were to indicate with a cross (X) in an appropriate box next to their choice of answer to the questions (Appendix A3.1). There were a few open-ended questions that required free responses from students.

3.6 CRITICAL QUESTION 2

What kinds of strategies are used by successful science teachers who teach in under-resourced schools?

Critical question 2 is a classroom question and was planned to deal with classroom procedures such as methodology, assessment, management and so forth.

3.6.1 INTERVIEWS

To capture information on this critical question, I interviewed the science teachers in the selected schools to identify the strategies they used to achieve success. This was going to make it possible for me to suggest better strategies to be used by other teachers who teach in similar under-resourced schools where results are poor.

3.6.2 CLASSROOM OBSERVATIONS

A systematic observation was conducted in each of the researched schools by the researcher to document the strategies used by successful science teachers. As it has been indicated earlier, I involved other teachers as observers. I gave these teachers guidelines as to what I wanted to observe and asked them to do the observation.

The reason for involving other teachers was to bring them into the process instead of making them feel as subjects of observation only. The observation was done in each of the four schools for five consecutive days on the same topic for comparisons to be done. This spread of observation was going to give a "richer picture" of the strategies in the sampled schools.

3.7 DATA ANALYSIS

I compared, analysed and interpreted the information gathered from the four schools using observation schedules that capture categorical data (for example, what strategies the teachers use).

The quantitative data of the research (that is, the student questionnaire) was analysed using the Statistical Package for Social Sciences (SPSS) that is available at the Centre for Education Research, Evaluation, and Policy (CEREP) at the University of Durban-Westville. I entered the questionnaire data for each student onto a spreadsheet using the SPSS programme and did frequency counts on students' level of confidence as measured on a 4-point range of scale. I again searched the semi-structured interview transcript for patterns of meaning across the teacher data-sets separating converging themes and diverging patterns in teacher responses to identify common trends.

Finally, I did a thorough analysis of categorical data using descriptive statistics and analysis of key themes in the narrative data. This was to enable me to determine whether both teachers and students responses in the sampled schools were true reflections of what takes place in their classrooms.

3.8 CONCLUSION

In this chapter, I expanded upon the various research instruments used for data collection and the methods that were involved. I have also highlighted briefly on both quantitative and qualitative approaches used for the analysis of data collected. In the next chapter the data collected

using the different data collection strategies will be fully analysed, discussed and interpreted.

CHAPTER 4

DATA ANALYSIS

4.1 INTRODUCTION

This chapter discusses a summary of the data collected from this study. As it has been stated earlier, the data were analysed using the SPSS programme. In this chapter also, findings from the research study are presented for the four (4) schools as a whole and cross-tabulation on certain indicators of the data set are compared.

4.2 ANALYSIS OF STUDENTS' QUESTIONNARE DATA

4.2.1 GENDER PROFILE

The gender profile of the students indicates that 53% of the students who participated in the study were females and 47% were males.

Table 1: Gender profile of students

School	Number of count (n)	Male	Female	Total
Bhokwe High	n=10	40.0%	60.0%	100.0%
Banzana High	n=21	57.1%	42.9%	100.0%
Hamu High	n=15	40.0%	60.0%	100.0%
Mangwazana High	n=30	46.7%	53.3%	100.0%
% of total	100	47.4%	52.6%	100.0%

Cross-tabulation analysis of the researched schools yielded the following results: At Bhokwe and Hamu High schools 60% of all the matriculation students in each school doing science were females and 40% were males.

Mangwazana High also had 53% (16 out of 30) females and 47% (14 out of 30) males offering science at Grade 12 level. At Banzana High 43% (9 out of 21) of the Grade12 physical science students were females and 57% (12 out of 21) were males. These results show that more girls than boys take physical science at matriculation level in the four researched schools except for Banzana High where the number of boys doing science slightly exceeds the girls. These results then show a slightly uneven balance of students who offer science in terms of gender in the four researched schools. The researcher has also observed from the school he teaches (Falaza High), that more females than males register for physical science at matriculation level. A newspaper article endorses this. According to the newspaper report, in 1996, in terms of gender more girls than boys sat for the matriculation examination in each province (Anstey 1997, Appendix 7). This study, therefore, disagree with the perception that the subject science is a masculine pursuit. Bently and Watts (1986) argue that school science and mathematics are seen as male-appropriate and female-inappropriate. Reid and Hodson (1989) also comment that girls do not wish to be seen competing with boys in subject areas perceived by girls themselves as "masculine" because their own emerging femininity might be seen as diluted in some ways. Some researchers also argue that pupil's attitudes towards opposite sex-involvement influence girls to develop a show of no interest towards science. For example, Byrne cites the example that boys in the British GIST (Girls into Science and Technology) projects were found labelling girls who did science as atypical and peculiar. Delamont (1994) also argues that women's brains are less suited to mathematical and scientific thoughts. The authors Bently and Watt (1986); Reid and Hodson (1989) and Delamont (1994) all argue that male's are more scientific. These

literatures to some extent are not applicable in rural KZN schools. For example, in the four researched schools there are more girls and a greater percentage of them wrote and passed physical science.

4.2.2MEDIUM OF INSTRUCTION

Table 2: showing medium of instruction in classrooms

School	Number of count (n)	Isizulu	English	English and Zulu	Total
Bhokwe	n=10		30.0%	70.0%	100.0%
Banzana	n=21		100.0%		100.00%
Hamu	n=15		100.0%		100.0%
Mangwazana	n=30		100.0%		100.0%
% of total	100		90.8%	9.2%	100.0%

The table above shows the cross-tabulation responses on the statement regarding the medium of instruction used in class. In the four researched schools, 91% (69 out of 76) of the students who responded to the questionnaires stated that the medium of instruction in the teaching of science in their classrooms is English while 9% (7 out of 76) said is both English and Zulu. Cross-tabulation data indicated that at Banzana, Hamu and Mangwazana High schools English is the only medium of instruction in science classrooms. This is to say, all the students in these schools agreed by indicating that English is the medium of instruction in their science class. It can be deduced from these three schools that language is not a problem to most learners since English has been used to communicate to them. Students in these schools have acquired some

basic skills that are one of the characteristics identified by Edmonds (1975) to be associated with effective schools. The science results in these three schools might have been good since most of the students do not appear to have language problems. Therefore in problem-solving in physical science, students have the ability to translate word problems into an internal representation such as equations and apply rules to solve them.

4.2.3 ASSESSMENT

Assessments in the four researched schools are mainly in the form of continuous and summative assessments. Continuous assessments in these schools mainly take the form of homework, class exercises and tests.

4.2.4 CLASS EXERCISES

At Bhokwe and Hamu High schools the data results indicate that students are given class exercises to do every day. That is, all the students in these schools indicated that they are given class exercise daily. At Banzana High school all the students (10 out of 10) agreed that they are given class exercises to do every week. At Mangwazana High school 69% (20 out of 29) of the students indicated that they do classroom exercises weekly while 17% (5 out of 29), 3% (1 out of 29) and 10% (3 out of 29) indicated "monthly", "daily" and "never" respectively. The data analyses shows the results in table 3.

Table 3: showing how often students do classroom exercises

School	Number of count (n)	Daily	Weekly	Monthly	Never	Total
Bhokwe	n=10	100.0%				100.0%
Banzana	n=20		100.0%			100.0%
Hamu	n=15	100.0%				100.0%
Mangwazana	n=29	3.4%	69.0%	17.2%	10.3%	100.0%
% of total	100	35.1%	54.1%	6.8%	4.1%	100.0%

There seems to be unreliability in these results. This might be due to different understandings of the questions.

4.2.5 HOMEWORK

Pertaining to homework, data analysis results indicate that students at Bhokwe High School are given homework daily while at Banzana homework is given to students weekly. At Hamu High school a greater percentage of the students (87%, 13 out of 15) agreed that they do homework daily while 13% (2 out of 15) indicated for weekly. Table 4 shows the analysis of the results in the researched schools.

Table 4: frequency of homework assignments

	(n)	Daily	Weekly	Monthly	Never	Total
Bhokwe	n=10	100.0%				100.0%
Banzana	n=21		100.0%			100.0%
Hamu	n=15	86.7%	13.3%			100.0%
Mangwazana	n=28	7.1%	46.4%	28.6%	17.9%	100.0%
% of total	100	33.8%	48.6%	10.8%	6.8%	100.0%

These results show that enough homework is given to students at Banzana, Bhokwe and Hamu. The matriculation results in these three schools might have been good because of adequate or regular homework being administered. That is, homework has a positive influence on students' achievements. This has been evidenced by Mackenzie (1983). Mackenzie (1983) pinpoints that schools that administer homework regularly and ensure that homework is marked generally have better academic outcomes. At Mangwazana High 7% (2 out of 28), 46% (13 out of 28), 29% (8 out of 28) and 18% (5 out of 28) indicated "daily", "weekly", "monthly" and "never" respectively in terms of homework set for students. This shows that at Mangwazana students write fewer homework assignments. A description of the teacher interview report will explain why less homework are administered at Mangwazana High School.

4.2.6 TEST

The analysis of test results is as shown in the table that follows.

Table 5: depicting frequency of tests

	(n)	Weekly	Monthly	Total
Bhokwe	n=10		100.0%	100.0%
Banzana	n=21		100.0%	100.0%
Hamu	n=14	71.4%	28.6%	100.0%
Mangwazana	n=30		100.0%	100.0%
% of total	100	13.3%	86.7%	100.0%

The data analysis from this study depicts that in all the researched schools students are tested regularly in terms of the Department's assessment policy. Tests are generally used to find out learning outcomes such as the ability to recall, organise and integrate ideas in a logical and meaningful manner. At Banzana, Bhokwe and Mangwazana data analysis results indicate that these schools administer tests every month. That is, all the students in these three schools agreed strongly that they write tests every month. It was only at Hamu High school where 71% (10 out of 14) of the respondents indicated that they write test weekly and 29% (4 out of 14) agreed on monthly. Teacher interview report from Hamu High school will explain this discrepancy later (refer to A8.2- assessment procedure at Hamu).

4.2.7 FEEDBACK ON TESTS

74% of the students (56 out of 76) in the researched schools said their teacher explained why their answers were right or wrong (feedback) "all

the time" after they had been tested. 9% (7 out of 76) agreed on "many times" while 17% (13 out of 76) indicated "sometimes". Cross-tabulation result for the four schools is shown in the table below.

Table 6: Feedback provided by teachers

	(n)	Sometimes	Many times	All the time	Total
Bhokwe	n=10	60.0%		40.0%	100.0%
Banzana	n=21		4.8%	95.2%	100.0%
Hamu	n=15	6.7%	6.7%	86.7%	100.0%
Mangwazana	n=30	20.0%	16.7%	63.3%	100.0%
% of total	100	17.1%	9.2%	73.7%	100.0%

On the basis of these results, one can conclude that students are provided with the necessary feedback with corrective measures in the schools being researched. This systematic feedback may explain the high matriculation pass rate in physical science in the four schools. The authors Grayson (1995), Rolfe and McPherson (1995) and Candy, Crebert, and O' Leary (1994) all stress the need for feedback. According to these writers regular systematic feedback is an effective assessment procedure that influences the learning of pupils. This is because feedback exposes pupils to their strengths and weaknesses and thereby enables them to modify their approaches.

4.2.8 PEDAGOGICAL CONTENT KNOWLEDGE

On the whole, 43% (33 out of 76) of the respondents rated their teacher's knowledge in terms of content as "excellent" while 36% (27 out of 76)

rated them as "very good" and 18% (14 out of 76) indicated as "good". These results show that in all the four schools involved in the research students generally perceived teachers who teach science at matriculation level as knowledgeable. This further indicates that pedagogical content knowledge of teachers contributes to high academic performance. This study therefore exposes the finding that strong content knowledge contributes towards high pass rate in physical science at certification level in the researched schools. The importance of content knowledge has been endorsed by Fraser and Tobin (1987a). These writers also argue that, "*content and pedagogical knowledge are essential ingredients of good teaching dispels the myth held by some that teaching skills can compensate for inadequate content mastery, and it suggests the importance of providing teachers with adequate pre-services and in-service experiences to equip them with content knowledge and discipline-specific pedagogical for subject teachers to teach.*"

4.2.9 OPPORTUNITIES FOR STUDENTS TO ASK QUESTIONS

Pertaining to the issue of questions in class, 87% (66out of 76) of the respondents agreed that they are allowed to ask questions freely in class "all the time" while 1% (1 out of 76) agreed on "many times" and 9% (7 out of 76) indicated sometimes. 3% (2 out of 76) indicated for "not at all". This is an indication that in the teaching and learning process of science in the schools involved in this study, opportunities are given to pupils to ask questions in class. Comparisons of the results on a school basis show the figures in the table that follows.

Table 7:showing opportunities for students to learn

	(n)	Not at all	Sometimes	Many times	All the time
Bhokwe	n=10		10.0%		90.0%
Banzana	n=21	4.8%			95.2%
Hamu	n=15			6.7%	93.3%
Mangwazana	n=30	3.3%	20.0%		76.7%
% of total	100	2.6%	9.2%	1.3%	86.8%

This study then comes out with the finding that students' learning in the researched schools have been enhanced positively because of the opportunities given to students to ask questions. Owunka (1981) has evidenced this situation by commenting that when teachers allow their pupils to ask questions and make their comments on the matter at hand without any inhibition creates an atmosphere for learning to take place. It can be concluded that the matriculation science results in the four research schools have been good because students are at liberty to ask questions in class.

4.2.10 CLASSROOM INTERACTION

On the whole, 76% (58 out of 76) of the respondents said they have good interaction with their teacher during science lessons "all the time" while 5% (4 out of 76) agreed on "many times" and 17% (13out of 76) indicated "sometimes". The figures in table 8 show the data analysis of the results.

Table 8: nature of interaction in classrooms

	(n)	Not at all	Sometimes	Many times	All the time
Bhokwe	n=10				100.0%
Banzana	n=21		14.3%		85.7%
Hamu	n=15		6.7%		93.3%
Mangwazana	n=30	3.3%	30.1%	13.3%	53.3%
% of total	100	1.3%	17.1%	5.3%	76.3%

This show that in the research schools pupils have good interaction with their teachers during science lessons. The establishments of good interaction in the classrooms of the schools in this study have led to effective teaching and learning. Tobin (1987a) who compared the teaching performance of two science teachers against that of other colleagues endorses this. He found that exemplary teachers had well-ordered classes with a conducive atmosphere characterised by pleasant interactions with students and subtle use of humour.

4.2.11 GROUPING IN CLASS

The overall view was that 54% (41 out of 76) of the students agreed that they work in "small groups" while 32% (24 out of 76) also agreed that they work as a "whole class". Comparison of the data results on a school basis is as shown in the table that follows.

Table 9: showing how students work in groups

	(n)	Whole class	Large groups	Small groups	Pairs	Singles
Bhokwe	n=10	70.0%				30.0%
Banzana	n=21	61.9%		23.8%		14.3%
Hamu	n=15			93.3%	6.7%	
Mangwazana	n=30	13.3%	13.3%	73.3%		
% of total	100	31.6%	5.3%	53.9%	1.3%	7.9%

In two of the schools (Bhokwe and Banzana) the findings from the study show that students work as a whole class on many occasions. At Bhokwe 70% (7 out of 10) of the students indicated that they work as a whole class. 62% (13 out of 21) of the respondents at Banzana also agreed that they work as a whole class. In the other two schools (Hamu and Mangwazana), results show that students work in small groups on many occasions. 93% (14 out of 15) indicated for small groups at Hamu while 73% (22 out of 30) at Mangwazana. Dimmock (1995) argues that students have different learning styles. In classrooms, it is observed that some students prefer working in groups; in pairs; on their own; in small groups; in large groups and as whole class. At Hamu and Mangwazana opportunities are created for students to work in small groups. The researcher strongly supports small group learning. In such a group (small group), all students benefit. This factor is likely to be one of the contributing factors explaining high performance in science at Hamu and Mangwazana. It must be mentioned that interactive or small group learning has its negative aspects. In small group learning, gifted learners

tend to dominate and monopolise discussions and at the same time exposes those who see themselves as failures.

4.2.12 SHARING IDEAS IN CLASS

Table 10: showing sharing of ideas in class

	(n)	Not at all	Some times	Many times	All the time
Bhokwe	n=10	10.0%		20.0%	70.0%
Banzana	n=21			4.8%	95.2%
Hamu	n=15		13.4%	20.0%	66.7%
Mangwazana	n=30	3.3%	26.7%	23.3%	46.7%
% of total	100	2.6%	13.2%	17.1%	67.1%

The general view was that **students like sharing ideas** with each other in class. Overall results show that 84% (64 out of 76) of the students share ideas in class on many occasions. In the process of sharing ideas students develop the qualities that help them to solve problems and to complete tasks on time. This strategy of sharing ideas possibly contributes to the high pass rate in physical science at matriculation level in the four schools being researched.

4.2.12 LEADERSHIP

Table 11: effect of leadership style of principal on students' learning

	(n)	Not at all	Sometimes	All the time	Total
Bhokwe	n=8	62.5%	25.0%	12.5%	100.00%
Banzana	n=21	57.1%	28.6%	14.3%	100.0%
Hamu	n=15	100.0%			100.0%
Mangwazana	n=27	70.4%	18.5%	11.1%	100.0%
% of total	100	71.8%	18.3%	9.9%	100.0%

72% (51 out of 71) of the student indicated that the leadership style of their principal does "not at all" have an influence on their learning. 18% agreed on "sometimes" and 10% indicated "all the time".

At the same time, 77% (57 out of 74) of the students indicated that their principal does "not at all" visit their class during science lessons and 22% (16 out of 74) indicated "sometimes" while 10% (7 out of 74) agreed on "all the time". This result to some extent, disagree with the standard literature that the leadership style of a principal has a direct positive impact on student's performance as suggested by Williams (1983). It can be argued that students are not aware as teachers of the impact of strong or weak leadership in the general good governance of a school. Hence it could be that the leadership style of the principals in the researched schools might have an indirect influence on students' achievement.

4.2.14 CLASSROOM CONTROL/MANAGEMENT

Students' rating in terms of classroom control/management showed the following pattern:

Table 12: students' rating of classroom control/management

	(n)	Excellent	Very good	Good	Poor	Total
Bhokwe	n=9	55.6%	22.2%	22.2%		100.0%
Banzana	n=21	23.8%	61.9%	14.3%		100.0%
Hamu	n=15	26.7%	53.3%	6.7%	13.3%	100.0%
Mangwazana	n=27	51.9%	18.5%	29.6%		100.00%
% of total	100	38.9%	38.9%	19.4%	2.8%	100.0%

39% (28 out of 72) of the students rated classroom management and control as "excellent". 39% (28 out of 72) was also the rating for "very good". 19% (14 out of 72) rated it as "good" and 3% (2 out of 72) agreed on "poor'. This result leads to the conclusion that in the research schools teachers have sufficient repertoire of discipline-specific pedagogical knowledge to facilitate learning adequately. This result shows that classroom management is crucial if teachers are to be successful facilitators of learning. Thus, discipline-specific pedagogical knowledge is a crucial ingredient for effective teaching and learning to take place as evidenced by Fraser and Tobin (1989).

4.2.15 QUALITY OF SCIENCE TEACHING

95% of the students agreed on the statement that "they like the way science is taught by their teachers in class" while 5% disagreed. Cross-tabulation analysis indicates the figures in table 13.

Table 13: showing students' perception of science teaching

	(n)	Yes	No	Total
Bhokwe	n=10	100.0%		100.0%
Banzana	n=21	90.5%	9.5%	100.0%
Hamu	n=15	100.0%		100.0%
Mangwazana	n=30	93.1%	6.9%	100.0%
% of total	100	94.6%	5.4%	100.0%

This result further supports that teachers in the four research schools have the necessary pedagogical content knowledge for the execution of their duties.

4.2.16 TEACHER'S PREPAREDNESS FOR LESSONS

Students' rating on their teachers' preparedness for lessons in classroom showed the following pattern;

36% (26 out of 73) rated it as "excellent"; 32% (23 out of 73) as "very good"; 22% (16 out of 73) agreed on "good" while 10% (7 out of 73) was the rating for "poor" and 1% (1 out of 73) for "very poor".

These results indicate that in the research schools teachers are generally dedicated and this has helped in boosting the matriculation results of these schools.

4.2.17 STUDENT'S WILLINGNESS TO CO-OPERATE

Students' rating on their willingness to co-operate in class during science lessons was found to follow the trend shown in table 14

Table 14: showing rating of students' willingness to co-operate

	(n)	Excellent	Very good	good	poor	very poor
Bhokwe	n=7		42.9%	28.6%	14.3%	14.3%
Banzana	n=21	33.3%	42.9%	23.8%		
Hamu	n=15	13.3%	66.7%	20.0%		
Mangwazana	n=28	21.4%	28.6%	42.9%		7.1%
% of total	100	21.1%	42.3%	31.0%	1.4%	4.2%

21% (15 out 71) agreed on "excellent", 42% (30 out of 71) on "very good" and 31% (22 out of 71) on "good". 1% (1 out of 71) rated it as "poor" while 4% (3 out of 71) was for "very poor". These results show an overall view of 94% of the students expressing their willingness to co-operate during science lessons. This factor is possibly a contributing factor explaining good results in the research schools.

4.2.18 GROUP WORK

The analysis on the statement based on active role played by students in group work follows the trend in table 15.

Table 15: students' active role in group work

	(n)	Not at all	sometimes	Many times	All the time
Bhokwe	N=10		10.0%	30.0%	60.0%
Banzana	N=21	14.3%	42.8%	19.0%	23.8%
Hamu	N=15		40.0%	33.3%	26.7%
Mangwazana	N=27	18.5%	44.4%	11.1%	25.9%
% of total	100	11.0%	38.4%	20.5%	30.1%

The analysis in Table 15 shows that about 51% (37 out of 73) of the respondents play a very active role in group work. Again, student's responses by their rating on working in groups also show that they like group work. Overall, the results from the study provide considerable evidence that students have a positive attitude towards group work. The general view was that 93% (71 out of 76) of the students had a strong positive attitude for working in groups by rating it high. Sharan and Sharan (1994) have endorsed on the usefulness of group work. They argue that a positive attitude towards group work creates opportunities for them to take responsibility and active management of their own learning.

4.2.19 PRACTICAL WORK

Table 16: showing students' involvement in practical work

School	(n)	Not at all	Sometimes	Many times	All the time
Bhokwe	n=10		100.0%		
Banzana	n=21	14.3%	81.0%	4.8%	
Hamu	n=15		20.0%	6.7%	73.3%
Mangwazana	n=29	13.8%	58.6%	13.8%	13.8%
% of total	100	9.3%	63.6%	8.0%	20.0%

On the whole, 9% (7 out 75) of the students felt that they were "not at all" involved in practical work while 63% (47 out of 75) agreed on "sometimes". At the same time, 8% (6 out of 75) indicated "many times" and 20% (15 out of 75) also agreed on "all the time". Cross-tabulation for the four schools showed the following trend. All the students at Bhokwe agreed on "sometimes" in terms of their involvement in practical work.

At Banzana, 14% (3 out of 21) indicated "not at all"; 81% (17 out of 21) agreed on "sometimes" and 5% (1 out of 21) was for "many times". At Hamu 20% (3 out of 15) was the indication for "sometimes", 7%(1 out of 15) strongly agreed on "many times" and 73% (11 out of 15) was for "all the time". The results at Mangwazana also showed the following pattern: 14% (4 out of 29) of the respondents agreed on "not at all", 59% (17 out of 29) "sometimes"; 14% (4 out of 29) 'many times" and 14% (4 out of 29) "all the time". These results show that few practicals were done in the research schools except for Hamu where pupils are more

often involved in practical work. This discrepancy suggests some unreliability in responses and perhaps could be corrected by observation.

4.2.20 CODE-SWITCHING

Analysis of the data captured shows the pattern in table 17 in terms of code-switching.

Table 17: showing the use of English along with local language

	(n)	Not at all	Sometimes	Many times	All the time	Total
Bhokwe	n=10		90.0%		10.0%	100.%
Banzana	n=21	100.0%				100.0%
Hamu	n=21	6.7%	93.3%			100.0%
Mangwazana	n=30	100.0%				100.0%
% of total	100	51.3%	38.2%		10.5%	100.0%

The data results show that at Banzana and Mangwazana teachers do not code-switch at all in class. In the other two schools (Bhokwe and Hamu) teachers code-switch at times. Thus, English and IsiZulu are used in the teaching of science.

At the same time, 47% (36 out of 76) of the students agreed on 'not at all" on the statement of using their local language to express their ideas in class while 43% (33 out of 76) indicated "sometimes" and 9% (7 out of 76) agreeing on "all the time" This is an indication that in the researched schools pupils are encouraged to use English. The use of

English in these schools is possibly one of the factors leading to a high pass rate at matriculation level in physical science.

4.2.21 CLASS DISCUSSION

Analysis of students' responses on the statement whether they learn from class discussions produced the figures in the table below.

Table 18: showing extent at which students learn from discussions

	(n)	Sometimes	Many times	All the time	Total
Bhokwe	n=10	20.0%	10.0%	70.0%	100.0%
Banzana	n=21	57.1%		42.9%	100.0%
Hamu	n=15	6.7%	26.7%	66.7%	100.0%
Mangwazana	n=29	41.4%	24.1%	34.5%	100.0%
% of total	100	36.0%	16.0%	48.0%	100.0%

The general view was that 48% (36 out of 75) of the students agreed on "all the time" on the statement that they learn from class discussions while 16% (12 out of 75) felt strongly it was "many times". 36% (27 out of 75) also indicated "sometimes". Comparison of the responses in the four schools showed the following trend: At Bhokwe, 70% (7 out of 10) indicated "all the time"; 10% (1 out of 10) "many times"; and 20% (2 out of 10) "sometimes". At Hamu 67% (10 out of 15) agreed on "all the time"; 27% (4 out of 15) "many times" and 7% (1 out of 15) was for "sometimes". At Mangwazana 35% (10 out of 29) indicated "all the time"; 24% (7 out of 29) "many times" and 41% (12 out 29) "sometimes". At Banzana 43% (9 out of 21) agreed on "all the time";

and 57% (12 out of 21) indicated "sometimes". These results show that in two of the research schools (Bhokwe and Hamu) students learn a lot from class discussions. Through discussions students talk together in order to share information and ideas about a topic or a problem or seek possible available evidence to support a claim or a solution to a problem. This might be a possible factor contributing to high science results at certification level in science at Bhokwe and Hamu.

4.2.22 USE OF PAST QUESTIONS

Table 19: use of previous examination papers according to students

	(n)	Not at all	Sometimes	Many times	All the time
Bhokwe	n=10		50.0%		50.0%
Banzana	n=21	9.5%	4.8%		85.7%
Hamu	n=15		6.7%	26.7%	66.7%
Mangwazana	n=28	3.6%	32.1%	14.3%	50.0%
% of total	100	4.1%	21.7%	10.8%	63.5%

The figures in table 19 show the analysis of student's responses on the use of past examination questions. 64% (47 out of 74) of the students agreed on "all the time" on the statement that their teacher discusses past or previous examination science questions in class while 11% (8 out of 74) also agreed on "many times". At the same time, 21.7% (16 out of 74) indicated "sometimes" and 4% (3 out of 74) for "not at all". This analysis shows that in all the schools involved in this study, teachers discuss past questions with the pupils. This is a possible factor explaining high

matriculation performance in the research schools since it exposes pupils to ways of answering examination questions and also the trend or style of setting questions.

4.2.23 TEACHER'S NOTES

Data analysis on the statement whether the teacher gives notes shows the trend in the table below.

Table 20: showing frequency of notes given by teachers

School	(n)	Not at all	Sometimes	Many times	All the time
Bhokwe	n=9				100.0%
Banzana	n=21		4.8%	4.8%	90.5%
Hamu	n=15	66.7%	26.7%		6.7%
Mangwazana	n=30		3.3%	6.7%	90.0%
% of total	100	13.3%	8.0%	4.0%	74.7%

As it concerns teacher's notes, the overall view showed the following pattern: 75% (56 out of 75) of the respondents agreed on "all the time" that their teacher give notes while 4% (3 out of 75) indicated "many times" and 8% (6 out of75) was the indication for "sometimes". At the same time, 13% (10 out of 75) agreed on "not at all".

Cross-tabulation for the four schools showed the following trend: All the students who responded at Bhokwe agreed on "all the time". At Banzana 91% indicated "all the time". 90% of the students at Mangwazana also agreed on "all the time". It was at Hamu where 67% (10 out of 15)

indicated "not at all" while 27% (4 out of 15) agreed on "sometimes" and 7% (1 out of 15) felt it was "all the time". This analysis shows that at Bhokwe, Banzana and Mangwazana teachers prepare their own notes by combining reading materials available.

4.2.24 VARIATION OF TEACHING APPROACHES

The analysis in the table below shows how the students responded to variation of teaching strategies.

Table 21: showing frequency in teaching strategies according to students

	(n)	Not at all	Sometimes	Many times	All the time
Bhokwe	n=7	28.6%	57.2%	14.3%	
Banzana	n=21	95.2%			4.8%
Hamu	n=15		20.0%	20.0%	60.0%
Mangwazana	n=30	3.3%	90.0%	3.3%	3.3%
% of total	100	31.5%	46.6%	6.8%	15.1%

Comparison of the results in the researched schools showed that at Hamu the standard ten physical science teacher varies his teaching approaches. 60% (9 out of 15) of the students in this school agreed on "all the time" on the statement that their teacher vary his approaches. 20% (3 out of 15) each was also indicated "many times" and "sometimes". This indicates that at Hamu pupils have varying learning styles. The matriculation results in this school might have been good because the method adopted

by the teacher promotes the learning of all pupils. Thus, the teacher tries to vary his teaching style to engage and involve all the learners.

On the other hand, in the other three schools (Bhokwe, Banzana and Mangwazana) the pupils felt strongly that their teachers do not vary their approaches to teaching. At Banzana 95% (20 out of 21) agreed on "not at all". At Bhokwe 29% (2 out of 7) who responded indicated "not at all" while 57% (4 out of 7) agreed on "sometimes". At Mangwazana, 90% (27 out of 30) indicated for "sometimes" and 3% (1 out of 30) each for "not at all"; "many times" and "all the time". But students in these schools do better at matriculation level. It could be that even though teaching approaches are the same (thus, not varied) but it may be a good and diverse type.

4.3 ANALYSIS OF TEACHER INTERVIEW RESPONSES (see Appendix A8)

This aspect of the research was focused on classroom processes in order to identify indicators that teachers saw as being linked to student achievement. The researcher's concern was three-fold:

1. Materials available for teaching and learning
2. How teachers interact in the classroom
3. Organisational matters in the classroom

4.3.1.1 MATERIALS AVAILABLE FOR TEACHING AND LEARNING

All the teachers in the researched schools agreed that they have some textbooks but very few in two of the schools (Hamu and Bhokwe). But,

in the case of equipment the teachers in all the four researched schools reported that they are very few. It was only at Hamu where the teacher stated that he makes use of other printed materials from the Sowetan newspaper produced by Williams Smith to supplement his teaching. This finding clearly indicates that the availability of materials (textbooks and equipment) is not a factor in explaining high level of achievement in science in the researched schools. This study, therefore, casts some doubts on the general perception by most educators, researchers and students that textbooks and equipment are powerful determinants of student's achievement since it does not apply to the four researched schools.

In the four schools researched, the grade twelve teachers who were involved in the study reported that they prepare their own notes. These teachers agreed that they use the few available textbooks to supplement their teaching. At the same time three of them (Banzana, Hamu and Mangwazana) felt that the best way of giving notes is a chalkboard summary while the teacher at Bhokwe argued that it should be through the process whereby pupils listen and write down their own notes. This indicates that the unavailability of materials compels teachers to make adequate preparations by compiling their own notes before they enter classrooms. This strategy possibly accounts for the high performance in the researched schools because in the process of note preparation, the teacher tries to read from various sources and summarises all the essential aspects meaningful to him or her for the pupils.

Diversity of materials: The list of curriculum materials is inexhaustible. There are a host of other materials including context-based and

improvised materials. The interview results reveal that in three of the researched schools (Hamu, Bhokwe and Mangwazana) the teachers responded in the positive on the issue of improvising by using items from the environment. These teachers reported that due to insufficient materials they make use of locally available materials in place of expensive and imported ones. For example, at Mangwazana the teacher uses the wheelbarrow to explain the ticker timer and also he uses an empty pen tube in place of a dropper. The results in these three schools might have been good because teachers in these schools try to contextualize their teaching of science. Owunka (1983) has endorsed on the importance of the use of locally available materials in the teaching of science. He stresses that the best way of helping pupils to learn is to bring them face to face with the world which education intends to introduce to them through the use of real things in real life situations. Jegede (1995) also argues that learning is influenced by environmental conditions. Thus, the use of everyday life situations to illustrate and introduce scientific concepts enhances the teaching and learning of science.

4.3.1.2 USE OF PAST QUESTIONS

All the four teachers involved in the research study also agreed that they make use of past examination questions in their teaching. They all argued that, through the use of past questions, pupils are exposed to the trend of how the questions are set and how to answer questions.

On the statement that whether the teachers in the schools being researched are able to include practicals in class work, three (3) out of the four (4) teachers (Hamu. Bhokwe and Mangwazana) strongly felt

"yes" and still demonstrate practicals to their pupils but not on many occasions, while the teacher at Banzana said he does not include practicals in his class work due to lack of equipment.

4.3.2 HOW TEACHERS TEACH

4.3.2.1 METHODOLOGY: In the researched schools, teachers vary their teaching approaches by using more than one method. At Hamu and Mangwazana the teachers employ the question and answer, demonstration and discussion methods of teaching. At Bhokwe the teacher mainly relies on lecture, discovery and experimentation methods while at Banzana the predominant methods are telling (lecture) and discussion. These results are an indication that teachers in the schools researched, in particular Hamu, Bhokwe and Mangwazana, vary their approaches to suit every occasion because different subject matter requires different teaching strategies (Owunka, 1953). Postlethwaite (1993) has also argued that variation in whole- class teaching as a strategy assists pupils since a range of teaching approaches, and a range of level of treatment that suits individuals in the classroom, helps to redress learners' differences. This strategy might be a powerful determinant of student's achievement in the schools researched.

In the teaching and learning process of science, two of the teachers (Hamu and Mangwazana), in responding to the interview questions, said they encourage flexibility in class by allowing their pupils to engage in their own discussions while the other two from Banzana and Bhokwe also said they allow their pupil to work in their preferred groups. It can be concluded that through discussion and group work pupils share ideas and learn from each other. This is also a possible factor leading to a high

pass rate in matriculation science in the four researched schools in this study.

4.3.2.2 LANGUAGE

In terms of language, all the teachers involved in the research responded that English is mainly the language of instruction in the teaching of science. However, two of the teachers (Hamu and Bhokwe) made it clear that they code-switch at times. In the other two schools Banzana and Mangwazana code-switching does not take place at all as reported by the teachers who teach physical science in these schools. Response from teachers at Banzana and Mangwazana indicates that language is not a major problem to students in these schools. This, possibly, may be one of the factors explaining high pass rates in science in these schools as the pupils have been developed in the language of science. This, therefore, tends to make the learning of science easier for pupils in these two schools.

On the other hand it could be argued that code-switching, which at times takes place at Hamu and Bhokwe, may also be a contributing factor to good matriculation results in these schools. Because code-switching is encouraged in these schools, the teachers try to use the local language (Zulu) to clarify concepts and terminologies where possible, thereby making it easier for learners to understand and learn science better. Caillods, Gottelmann-Duret and Lewin (1997) have confirmed this. They highlight that in Korea, Malaysia, Thailand and Japan where secondary science is provided in a national language, contributes to high performance of students since it makes science studies accessible to all.

4.3.2.3 ASSESSMENT

Teachers who were interviewed in the schools researched said that in terms of assessment they generally administer class work, homework and tests. At Bhokwe and Hamu the teachers mentioned that they give homework daily while at Banzana homework is given weekly. It was at Mangwazana where the teacher clearly stated that he gives very little homework because he has observed that some students used to copy from other students. The high pass rate in science at Hamu, Bhokwe and Banzana is possibly due to enough homework being administered in these schools. Mackenzie (1983) has evidenced this by saying that schools that administer homework on a regular basis and ensure that the homework is marked generally have better academic outcomes. In terms of tests, all the researched schools write at least one test in every month. However, at Bhokwe the teacher made it clear that he administered tests at anytime he completes a chapter and so his assessment is not a matter of weeks or months. Concerning marking, all the four teachers responded yes to the marking of homework, class work and tests. However, pertaining to class work and homework the teachers at Hamu, Bhokwe and Banzana mentioned that they involve students in order to speed up the marking. At the same time, the four teachers involved in the study responded that they provide feedback with corrective measures after assessing their pupils. These findings indicate that assessment in the researched schools is regular. The matriculation results in these four schools being researched might have been good also because of regular assessments in the form of class work and tests. The writers Rolfe and Mcpherson (1995), Grayson (1994) and Candy, Crebert and O'Leary ((1994) have endorsed on regular systematic feedback as an effective assessment procedure that influences the learning of students.

It should also be recalled that in the four schools researched all the teachers responded in the positive that they link their assessment to classroom teaching. For example, teachers in these schools ensure that their test questions reflect the way the topics are treated in class. This means that assessment in these schools satisfies the criteria of validity. From the researchers own teaching and assessment procedure's validity in assessment means that assessment should do exactly what it is expected to do. This is to say it should measure exactly what the teacher expects to measure. One can conclude from this that students in the researched schools perform better in science at matriculation level because of the validity in the assessments in these schools. Grayson (1994), Rolfe and McPherson (1995) and Candy, Crebert and O'Leary (1994) have endorsed on a close link in the way assessments are made. Thus, there should be links between classroom teaching and formative assessments, and summative assessments should also have a close bearing on formative assessments. That is there should be some interconnectedness between formative and summative assessments.

4.3.3 ORGANISATIONAL MATTERS

For effective teaching and learning to take place, there should be some kind of supporting organisational structures or arrangements. Such organisational structures need to be flexible in some ways to enable pupils to cope with classroom situations. As far as classroom organisation is concerned, all the teachers who were involved in the research responded that they organise their classrooms by grouping students. At the same time, these teachers said they ensure that there is discipline through a variety of strategies.

4.4 CLASSROOM OBSERVATION

The classroom observation was to provide a richer picture about general conditions in the schools, teaching methods, quality of learning taking place, use of materials and equipment, classroom organisation, management and control. As it has been said earlier, observation was done in each school for five consecutive days.

4.4.1 MATERIALS USED TO FACILITATE LEARNING

In all the lessons observed in the four schools the teachers talked and made good use of the chalkboard. It was also observed that two of the teachers (Mangwazana and Bhokwe) sometimes referred to textbooks. The teacher at Banzana relied heavily on a textbook while at Hamu the teacher sometimes depended on printed materials from the "Sowetan".

4.4.2 MATERIALS MANIPULATED BY STUDENTS

In the lessons observed in the four schools materials, manipulated by students included textbooks and notebooks. It was at Hamu and Bhokwe where some students manipulated other materials. At Hamu these students used study guides (physical science answer series) while at Bhokwe they interacted with handouts.

4.4.3 TEACHING METHODS

Question-and-answer method of teaching was found to be dominating in each of the research schools. In one of the lessons observed at Hamu, the teacher used an experiment. At Bhokwe also the demonstration method was used once. In all other lessons observed in the four schools the

method used was the lecture and summary of points. It was only at Hamu and Bhokwe where discussion took place in one of the lessons.

4.4.4 GROUPINGS

At Banzana and Hamu grouping of students was observed. However, this grouping or arrangement of students was not fixed. Learners in both classrooms in these schools sat in small groups of 3-5. In one of the lessons observed in these two schools there were no groupings as whole class instruction took place. At Bhokwe and Mangwazana, the grouping of students was not observed.

4.4.5 GROUP WORK

Group work was noticed in all the classrooms during observation. However, there was little learner-learner discussion. In two of the observations in all the schools students discussed problems and question in small groups.

In one of the observations at Hamu and Banzana students sat individually and there was no sign of communication among students. I also observed on my second observation at Hamu that, the class was divided into four groups and discussion took place among students in each group and one person had to present for each group later.

4.4.6 TEACHER-LED QUESTIONS

This was the most dominant feature in almost all the lessons observed. The teachers in the four researched schools were fond of mixing question with their talking. Both closed and open-ended questions were asked by these teachers.

4.4.7 STUDENT-INITIATED QUESTIONS

This was one of the least observed events in the four classrooms. However, in one or two of the lessons observed in each school, students asked simple questions. Sometimes, these questions were for clarification of specific concepts.

4.4.8 MEDIUM OF INSTRUCTION

English was the dominant language of instruction in all the lessons observed. At Hamu, Banzana and Mangwazana English was used throughout the observation period. It was only at Bhokwe where the teacher code-switched at times in all the lessons observed to explain key concepts.

4.4.9 OPPORTUNITIES FOR STUDENTS TO LEARN

Equal chance was given to pupils to participate in class activities in the lessons observed in each of the four schools. However, it appeared that girls participated more actively than boys at Banzana.

4.4.10 TEACHER'S NOTES

The chalkboard summary was the dominant means of given notes in all the classrooms observed as teaching took place. It was at Hamu where the teacher in one of his lessons gave notes from the "Sowetan".

4.4.11 CLASSROOM MATERIALS AND RESOURCES

All the classrooms observed had no materials and resources like charts, projectors, Science equipment, Bunsen burners and chemicals. Electricity

was also not available in any of the classrooms. The only resource material found in each classroom was the chalkboard.

4.4.12 TEACHER-STUDENT BEHAVIOUR

Generally in all the lessons observed in the four schools, students were very attentive and teacher-pupil interaction encouraging. Effective classroom discipline was observed in each classroom during observation.

CONCLUSION

To conclude this chapter, I need to mention that the findings from this study are not all that amazing, nor did they provide good grounds for total optimism. Some of the common findings from other past research departs from the findings of this study. For example, in terms of gender, more girls than boys register for physical science at matriculation level. Thus, the study disagrees with the perception that science is a masculine pursuit. However, most of the findings emerged from this study will serve to provide a refreshing alternative to research that maligns science education by focusing on outstanding strategies of teaching.

CHAPTER 5

CONCLUSION AND IMPLICATIONS

5.1 INTRODUCTION

This chapter gives a summary of the research findings. Also, the researcher presents the implications based on the findings from the research study. These implications will be useful to educators of science in schools with limited resources and future science education research that investigates what is happening in effective schools, especially those in rural underdeveloped areas.

5.2 SUMMARY OF THE RESEARCH

The findings from each of the schools researched have been synthesised to identify common characteristics in these schools involved in the research. Although not all of the characteristics identified were common, some common trends or patterns that emerged are likely to enrich other teachers' teaching of science. The overall picture is that all four schools involved in the research are good and did well across the board. However, some are better than others. There are other schools in the Ulundi Region that were not involved in the research who performed badly in science. Statistics at Nongoma circuit office indicates that some of these schools got 4%, 15% and 20% pass rate in science for the 1998 matriculation exams. This indicates that the four researched schools can be regarded in this study, as effective.

As the results show, Hamu, which is clearly doing all things which effective schools literature suggests, got 85% pass rate in science. Hamu

did better than Banzana which has good discipline but poor teaching methods and lacks materials to facilitate learning. This school (Banzana) got a 69% pass rate in science. This implies that students at Hamu really understood concepts and had not memorised them without understanding.

Bhokwe and Mangwazana got 100% and 96% passes in science respectively. Hamu High School, which is doing a wide variety of extraordinary, interesting and progressive activities (such as using cuttings from the Sowetan newspaper, visiting nearby schools for equipment and improvising, using items from the environment), and is making the best of a difficult situation, obtained a pass rate lower than that of Bhokwe and Mangwazana. This suggests that there might be problems in the system. For example the kind of questions set for matriculation students allow students to pass even if they learn by rote. To be precise, the matriculation questions in physical science follow the same pattern yearly. Hence teachers at Bhokwe and Mangwazana may focus their teaching on the pattern used in the setting of the questions and repeatedly, solve more problems on past questions with students, showing them how to answer questions during examinations, rather than making students more knowledgeable, skilful, and critical.

The findings from the study indicate that each of the four schools involved in the study adopts strategies to achieve good science results at matriculation level. For example, Hamu, Bhokwe and Mangwazana are doing well as compared to Banzana in terms of teaching methods and improvisation. At Hamu, Bhokwe and Mangwazana the teachers use a combination of teaching methods. The lecture, discovery and

experimentation methods are used at Bhokwe. The teachers at Hamu and Mangwazana also use the question and answer, demonstration and discussion methods while at Banzana only the lecture and discussion methods are used. This may explain why the matriculation results at Hamu, Bhokwe and Mangwazana are better than that at Banzana where very traditional and limited methods are in place. In the progressively taught schools, the matriculation results are very different and high. This indicates that the literature on effective schools is justified.

As it has been said earlier, some common trends or patterns emerged from the findings of the study. These common characteristics all enhance the teaching and learning of science in the schools involved in the study. The characteristics that were common are that:

(a) the assessment methods in the four researched schools have been found to be appropriate and convenient. Regular assessment with the necessary corrective measures (systematic feedback) in the researched schools may explain the high matriculation pass rate in science. Regular assessment can assist a teacher to diagnose learning potential and provide appropriate counselling or remedial instruction.

(b) the pedagogical content knowledge of a teacher contributes highly towards improved academic performance of the learners.

(c) flexibility in class (for example, opportunities for learners to learn in their own preferred ways and the establishment of good interaction in class) leads to effective learning. This recognises that education is a process and not an event. It thus enables the learners to learn at their own

pace and again, to learn from the evaluation and change. It is therefore oriented towards the development of the individual.

(d) discipline specific pedagogical knowledge (classroom management or control) is crucial for effective teaching and learning of science to take place.

(e) co-operation on the side of both teachers and pupils in class during science lessons is a possible factor explaining good science results in the researched schools. Through co-operation students take responsibility for active engagement in their own learning.

(f) even though not much group work was observed, the researcher holds a strong view that a positive attitude towards group work creates opportunities for active learning to take place. In groups, members discuss their work in order to exchange ideas and information, expand, clarify and integrate them.

(g) the use of English along with the local language in the teaching of science (at Hamu and Bhokwe), particularly in the clarification of key concepts and terminology, makes the learning of the subject more accessible to all learners.

(h) the discussion of past science examination questions in class greatly helps pupils. As students discuss previous or past questions they become used to approaches of answering examination questions.

(i) variation of teaching approaches in class caters for all learners. Thus, a range of teaching methods from discussion, question and answer to co-operative learning and a range of level of treatment serves to address learners' differences.

It must be mentioned that these substantive findings have important implications for the enrichment of the teaching and learning of science in other environments with limited resources.

5.3 IMPLICATIONS OF THE STUDY FOR FURTHER RESEARCH

The study poses a deeper question about what is happening in effective schools since no single working definition or concept may explain school effectiveness. The overall view is that effective schools appear to adopt strategies that encourage pupils to learn. Banzana for example seems to adopt learning strategies that allow pupils to pass matriculation exams without having clear insights into science and therefore may not produce good scientists at the end. This means that this school (Banzana) appears effective, because students pass through rote-learning. Thus, there might be some limitations in the kind of questions set for matriculation students that allow them pass even if they had "rote" learned. Jansen (1999) confirms this. He comments that the matriculation examination encourages rote learning. This is where the problem lies. The implication here might be that a further study following these students into tertiary education could reveal a marked difference. It is be suspected that the "rote" learners would battle, while the self motivated ones already able to

take notes, do practicals, work interactively, and so forth would work their way through.

Another implication is that further research needs to be done in order to set an agenda for a framework on effective schools. Thus, the study provides grounds for optimism about the future of science education even in situations where the teaching and learning environment is far from ideal.

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APPENDICES

APPENDIX A1:

The critical difference between schools that deliver and those that don't must be identified, writes SUZANNE REES

End the rhetoric: We need efficiency

IT IS time to stop whining about poor matric results. What we have to do is call a spade a spade, acknowledge what makes some schools produce good results while others continue to disappoint and then take brave practical steps to remedy the situation.

We have had 20 months of post-election education and the matric results are worse than ever, described as a "shock fail". But why the shock? It is nothing new that most South African education is shocking.

Professor Sibusiso Bengu, the national Minister of Education, may deliver political rhetoric — "radical steps"; single matric examinations; making integration of schools compulsory and any number of other nice emotional statements (I am amazed that he didn't bring in the Model C whipping boy) — but until the critical difference between schools that deliver and those that don't is identified and acknowledged there will be no significant change.

How, for example, can his proposal to have all the pupils write a single matric examination change the competence of the candidates to pass his examination?

The problem is not that the children write different exams. The problem is that a large number of children are being poorly educated in ineffective schools.

Can the minister possibly believe that it is the integration of schools per se that improves the children's chances of success, or does he recognise that it is because they are at least in schools which do the job properly?

All this rhetoric may make political sense, but it certainly doesn't make educational sense — and to hide behind post-apartheid excuses at this critical time is madness.

If it continues, I predict that the results released in December 1996 will still be shocking, perhaps even more shocking.

Of course some of the weaknesses in schools can be blamed on past inequities, and Professor Bengu may be right that "sustained stability" is necessary before the changes can be dealt, but it is not helpful to dwell on past difficulties. It is also not helpful to talk of the proposed national qualifications forum and the new curriculum as some kind of panacea.

Restructuring the system is very important, and good work is being done in this area but, for the pupils at senior secondary schools and their hopeful, worried parents, it is of little consequence.

What they need is effective schooling, schooling which delivers to them the means to gain the coveted matric. Their need is immediate.

The term "effective" means having the desired effect. Effective schooling means that pupils receive a specified curriculum in such a way that at the end of the course of schooling they are able to demonstrate knowledge of this curriculum; in our country this means passing matric.

Effective schools have principals who focus the school's energy, support the teachers and direct and discipline the pupils. They have management teams which prepare the timetable and programmes ahead of time so that pupils begin their studies the day that school opens. They have parents and pupils who appreciate the efforts the school makes on their behalf and who therefore co-operate in the shared endeavour of achieving the best results possible.

Most importantly, effective schools have teachers who can do the job well. These are teachers with sound subject knowledge, demonstration and questioning skills, good communication, discipline and management techniques, the ability to keep pupils focused and working on the task. In short, these are skilled teachers.

In an effective school the teachers take their responsibilities seriously. You do not find "work-to-rule" attitudes with several teachers in the staff room while classes are doubled up to allow for free periods, neither do you find teachers arriving late and leaving early as a matter of course.

The country can boast quite a number of effective schools within the state education system.

These schools have not achieved their effectiveness through rhetoric, they have achieved it through sustained effort.

These schools do not need Professor Bengu to force integration on them. They are already the most integrated schools in the country. Integrated because they produce good results and people want their children educated there. It is a revealing exercise to find out where the teachers and education department officials send their children to be educated: they know which are the effective schools.

Where Professor Bengu is making good sense is in seeking an increased budget for education. One recognises that the country cannot afford to pour money endlessly into a failing system, but to reduce the funds available to education at the very time it needs them most is ludicrous.

Money alone will not make the ineffective schools better but it will certainly help. To raise this money by laying off thousands of teachers, many of them the very teachers who make some of the country's schools effective, is nothing short of senseless. This is an imperative which the cabinet must recognise.

In turn, the teaching profession must put its house in order. Teachers lacking training or skills must put aside their Unisa studies and take courses which upgrade their classroom practice.

Teachers with little or no knowledge of African languages must recognise that their communication skills are limited and do something about it. Principals whose schools do not run well must study organisation and management.

We need to restore a sense of professional pride and responsibility to all teachers. The public can help in this, first by supporting the teachers in their efforts and then by making them accountable for the quality of the education paid for by the taxpayer.

This way, perhaps, the country will have a state education system it can be proud of, one which delivers competent, educated youngsters to the economy.

It cannot afford the loss of potential which is presently symbolised by the dreadful matric results of 1995.

● *Suzanne Rees is the president of the Association of Professional Teachers.*

APPENDIX A2:

So, what went wrong with the matric class of 97?

Lizesh Meerachs
Sunday Times
January 11/1998

main task of the South ican Certification Council ıcert) is to issue certifi- points of withdrawal from ıd technical college educa- so has to ensure that these es represent the same of examination. To fulfil cial assignment it must the Senior Certificate ions of the various provin- ation departments.
t of its efforts to maintain s, the council requires that papers be submitted to moderators for approval. ately, this procedure alone uarantee the same stan- lifferent examining bodies, ne year to the next.
ıtify possible variations in which may still occur, raw e compared with desired ted mark distributions. gnificant deviations are raw marks are adjusted ıem closer to the desired ons.
ɔdian of examination stan- cert exercises strict con- nark adjustment.
he provincial education ıts conducted their first ɔns at the end of 1996, ɔected the candidates to : about the same level as ıd determined its desired ns accordingly.
ɔectation did not materi- substantial upward ad- of marks were required e pass rate to 52 percent, ıt lower than in 1995.
ı these adjustments were able, some of them were gainst the limits of what ɔnably be allowed.

This year's bad results are merely the continuation of a trend which began in the 80s, writes Dr FRED CALITZ

Fearing a further decrease in achievement in 1997, Safcert determined new, slightly less favourable, desired distributions. The raw marks for 1997 showed that Safcert's fears were justified.

Acceptable adjustments yielded the weaker results which have just been announced. It was clear that further increases in the raw marks to try to match the results of 1996 would have meant a definite lowering of examination standards.

Safcert also took a firm stand that adjustments of marks could be used only to compensate for variations in the standard of the examination, and not to correct deficiencies which arose in the classroom.

Although Safcert's function is to determine standards; to measure the level of achievement against these standards and to issue certificates — and not to address deficiencies in the education system — a Safcert official cannot avoid observing and being concerned about what is happening.

What follows is, however, a purely personal opinion, and not the official view of the council.

So, what went wrong? What is being observed is not a sudden problem. It is a continuation of a trend which started in the 80s: a steady increase in the number of candidates of the former Department of Education and Training from about 72 000 in 1985 to 230 000 in 1991 to 341 000 in 1993, accompanied by a gradual but steady decline in performance from 48 percent passing in 1985 to 41 percent passing in 1991 to 38 percent passing in 1993.

The number of candidates countrywide increased from 272 000 in 1988 to 560 000 in 1997. Such increases put a tremendous strain on resources, and a high degree of dedication is required to maintain success rates under these conditions.

This dedication exists in only a relatively small number of schools. The bulk of the pupils are subjected to conditions where resources are inadequate, the standard of teaching is low, there is hardly any discipline and morale is low, so that the standard of learning is low.

Contributing to these woes is the fact that pupils are advanced from one grade to the next indiscriminately, so that the teacher is confronted by learners who lack the necessary pre-knowledge but must be prepared for the final examination anyway.

Another factor to be considered is subject choice. In 1997 more than 80 percent of candidates from six of the nine provinces offered subject sets which could lead to university admission, with the accompanying preponderance of subjects on the higher grade.

In a seventh province this figure was 70 percent, and 50 percent in the other two. Offering subjects on the higher grade to so many pupils not only puts a severe strain on already limited resources, but also lessens their chances of success, and does not really prepare them for anything other than academic study. In this context it can definitely be said that the study material is irrelevant.

How can matters be put right? There is no instant solution to the problem, and a tremendous effort will be required just to stop the decline and then to bring about a gradual improvement. It is not good enough to merely pay lip service to this idea: it should be realised that the magnitude of the effort which is required is perhaps bigger than anyone can envisage.

As a first step, discipline must be brought back into the classroom — strict discipline directed towards teachers, learners and administrators alike. The improvement of resources depends on money being available, and as finances are limited, such improvements will only be realised over a lengthy period.

In the meantime, teachers, learners, administrators and parents will have to give their wholehearted support to making do with what is available. Everyone will have to become involved in creating a culture of learning and teaching, and improving the standards of these activities.

The relevance of what is being taught should be emphasised to a far greater extent. It is true that Curriculum 2005, with its accent on outcomes-based education, is intended, among other things, to address the relevance of study material.

It should, however, be borne in mind that Curriculum 2005 is only in an experimental phase at this stage, and many complications will still have to be overcome before it will be in full swing, so that the present system must continue for quite some time.

In some circles it is felt that the heavy emphasis placed on the once-off Senior Certificate examination should be toned down by using continuous assessment as part of the final results, thereby enhancing a candidate's chances of success.

This is not an instant solution either, as there is a real probability that such a course of action can result in a lowering of standards while teachers are being trained to apply the appropriate standards to the continuous assessment.

It is already quite a task to train selected teachers to become markers in the final examinations, and much more will be required to train all teachers to become proficient in assessment.

To establish a solid educational system is clearly going to be a mammoth task which will take anything up to 15 years to accomplish.

In the meantime, matters will get worse before they improve.

● *Calitz is executive officer of the South African Certification Council*

□ *Visit www.suntimes.co.za/edu to have your say on the exam results or to check matric results*

Natal Mercury Sunday Times 11/1/98.

Teach our children well from the start and it will pay off later

The achievement of good matric results starts in the first three years of primary school, says MARK HENNING

TO ASK what went wrong with matric is to imply that it was better in the past, and might well be worse in the future. These assumptions should certainly be contested.

For a minority, the examinations have been the climax of 12 years of substantial, acceptable schooling, but for the majority they epitomise an irrelevant system dominated by gross disparity of provision.

At a recent conference in Chicago Peter Drukker, an authority on organisational management, responded sharply to a speaker who was advancing valid and politically correct reasons for the appallingly low achievement in inner-city American schools. Drukker said the speaker was doing the poor no favour by making excuses for them. He argued there were schools in the most difficult areas that were successful simply because they had discipline and high expectations.

We have our own examples of this. Adam's Mission School obtained a 100 percent pass rate by insisting that teachers and students were at school, that they worked, and that all attended a two-hour study period after school each day. However, important as this obvious lesson is, it would be wrong to say that it was the end of the story.

The furore around the matric results is best understood in human terms. The scale of failure is enormous. In Northern Province, for example, 86 000 young people failed. In Kwazulu Natal, half of the candidates entered for mathematics higher grade scored less than 14 percent, and they were presumably a select group of around a fifth of those who wrote their final school examinations. There was simply no substance to their learning.

Every human society educates its young, for on this depends its very survival. For individual parents there is another, deeper emotion. Parental love has about it intimations of immortality, experienced in a longing for happiness for one's children, grandchildren and great-grandchildren. Where this is weakened, the nation is in harm's way.

Some teachers have attributed the appalling 1997 results to just such parental neglect. But the reasons for the calamity are more complex, and there is no reason to be so pessimistic. Most parents have normal desires for their children, despite the burdens of poverty and unemployment so many carry.

An optimistic sign is that a factor in the poorer results is the SA Certification Council's refusal to raise marks by more than 10 percent in the standard annual statistical adjustments. This refusal and its acceptance indicate an understanding that real learning over a long period is required if matric qualifications are to be more than useless certificates of occasional attendance.

The present poor results are merely a symptom of an underlying malaise. In our best schools (which include urban and rural, privileged and deprived schools), children have achieved the desired objectives of creativity, enthusiasm for education, and a willingness and ability to continue learning. Good teachers who have worked with children there have overcome the weakness of a system dominated by an external exam. They have made their students active participants in the learning process. Youngsters have learnt to use knowledge, think creatively and continue learning on their own, with enthusiasm.

But in most schools there has been a pattern of rote learning from the first years. This is hard to break, and has led to a loss of interest and a deadening of curiosity on the part of both teachers and students.

The achievement of good matric results starts in the first three years of primary school. There, children start on a journey of developing the high-order intellectual skills of reading, writing and numeracy. They do this while learning how to think and work, and get on with others.

In assessing what went wrong with matric, the starting point has to be an analysis of this foundation level (if not of even earlier years).

If the matric exams are to have any rigour, there can be no instant cures higher up, although there may be palliatives.

It is also likely that we have gone further astray in the schooling of children from eight to 13 years. There is now a great deal of scientific evidence that the acquisition of knowledge and the development of understanding in these years is closely linked to the growth pattern of the central nervous system.

Children need more organised structures than those generally provided to enable them to develop satisfactorily.

Existing teaching strategies, assessment and promotion regulations have not taken this sufficiently into account, making later success less likely. Many who wrote matric were simply not prepared for work at that level, and were misled into believing that they were.

We heave undervalued the importance of teachers of quality. In good schools, fine teachers show a remarkable pride in their work. Daily, such teachers demonstrate the quality of their own education and the zest they have for personal growth. Ask principals of famous schools of their biggest concern, and they invariably cite the continued supply of such dedicated staff.

Students from good schools have consistently achieved sound results while at the same time developing critical judgment, forming critical skills and shaping artistic sensibility. Creativity, enthusiasm for education and personal initiative are difficult to measure, but they are understood and nurtured by good teachers.

The quality of students entering the profession and the training they receive is another critical factor in the analysis of what has gone wrong with matric. The teacher-training audit completed last year showed how poorly served Sou
been in this regard (w
ticeable exceptions). T
uation cannot be
overnight; indeed, ther
rious questions raise
short- and medium-t
given the low morale
dents and lecturers in t
ing colleges.

The financial prob
provincial education
and the severance pac
deployment schemes h
morale, while econom
sitional tensions have
part, together with
youth unemployment.

The outcry over the
indication that all is not
At both national and
level there is an acute
ing of the needs of the c
Department of Educatio
duced policies on whic
been wide agreement. T
sion, shared by many of
a South Africa in which
of life will improve, wit
not leading to divisivene
a realisation that continu
tively implemented edu
help make this a better
The matric disappoint
force politicians, officia
public to reassess the p
strong imperative for re
transformation has unde
characterised departmer
ing, and will continue to
organised teaching profe
flexed the muscle it has th
Educators' Bargaining C
seek better conditions for
Moves towards outcon
education are aimed at t
ing schools so they fit int
tional qualifications frame

Now it will be realised t
giant leaps must begin w
small steps, like getting
and students into classroo

● *Henning is national d*
the Independent Schools Co

APPENDIX A4:

RESEARCH INSTRUMENTS USED

APPENDIX A4.1:

STUDENT'S QUESTIONNAIRE.

BIOGRAPHICAL DETAILS

Name of School

.....

.....

Sex 1 MALE 2 FEMALE

What is your mother language?

1 ZULU 2 XHOSA 3 ENGLISH 4 SOTHO

5 OTHER(specify).....

What is the medium of instruction in your class?

1 ZULU 2 ENGLISH 3 ZULU & ENGLISH

4 OTHER(specify).....

ANSWER THE QUESTIONS BELOW

1. How often does the teacher involve the class in practical work?

1 NOT AT ALL 2 SOMETIMES

3 MANY TIMES 4 ALL THE TIME

2. Do you have a good interaction with your teacher during science lessons?

1 NOT AT ALL 2 SOMETIMES

3 MANY TIMES 4 ALL THE TIME

3. Does the teacher give you notes?

1 NOT AT ALL 2 SOMETIMES

3 MANY TIMES 4 ALL THE TIME

4. In what form does the teacher give you notes? Explain briefly(e.g. Dictation; Chalkboard summary etc.)

.....

.....

5. Does the teacher involve the class in group work?

1 NOT AT ALL 2 SOMETIMES

3 MANY TIMES 4 ALL THE TIME

6. Does your science teacher code-switch (use English and Zulu language when teaching science)?

1 NOT AT ALL 2 SOMETIMES

3 MANY TIMES 4 ALL THE TIME

7. Does your teacher organise extra science classes for you?

1 NOT AT ALL 2 SOMETIMES

3 MANY TIMES 4 ALL THE TIME

8. Does the teacher vary his or her approaches to teaching (use different methods of teaching science)?

1 NOT AT ALL 2 SOMETIMES

3 MANY TIMES 4 ALL THE TIME

9. Does the teacher discuss previous or past questions from the matric physical science exams?

1 NOT AT ALL 2 SOMETIMES

3 MANY TIMES 4 ALL THE TIME

10. How often does the your science teacher give the class an exercise (problems solved in class) to do?

1 DAILY 2 WEEKLY 3 MONTHLY 4 NEVER

11. Does your science teacher ever miss his or her class periods when he or she is supposed to be teaching?

1 NOT AT ALL 2 SOMETIMES

3 MANY TIMES 4 ALL THE TIME

12. How often does your science teacher give you homework to do?

1 DAILY 2 WEEKLY 3 MONTHLY 4 NEVER

13. How often do you write tests?

1 DAILY 2 WEEKLY 3 MONTHLY 4 NEVER

14. Does the teacher mark class exercises and homework?

1 NOT AT ALL 2 SOMETIMES

3 MANY TIMES 4 ALL THE TIME

15. Are you given feedback on your homework assignments (that is, does the teacher explain why your answers are right or wrong)?

1 NOT AT ALL 2 SOMETIMES

3 MANY TIMES 4 ALL THE TIME

16 . Does the teacher discuss test with the class (feedback)?

1 NOT AT ALL 2 SOMETIMES

3 MANY TIMES 4 ALL THE TIME

17. Are you allowed to ask questions in class?

1 NOT AT ALL 2 SOMETIMES

3 MANY TIMES 4 ALL THE TIME

18. Do you share your ideas with other students in class?

1 NOT AT ALL 2 SOMETIMES

3 MANY TIMES 4 ALL THE TIME

19. Are you allowed to use your home language (isiZulu) to express your ideas in class?

1 NOT AT ALL 2 SOMETIMES

3 MANY TIMES 4 ALL THE TIME

20. How do students work in groups? IN

1 WHOLE CLASS 2 LARGE GROUPS 3 SMALL GROUPS

4 PAIRS 5 SINGLES

21. Do you learn from class discussions?

1 NOT AT ALL 2 SOMETIMES

3 MANY TIMES 4 ALL THE TIME

22. Do you find the use of English a problem in science lessons?

1 NOT AT ALL 2 SOMETIMES

3 MANY TIMES 4 ALL THE TIME

23. Does the teacher involve the class in science activities?

1 NOT AT ALL 2 SOMETIMES

3 MANY TIMES 4 ALL THE TIME

24. Does your teacher provide you with individual help or assistance in science?

1 NOT AT ALL 2 SOMETIMES

3 MANY TIMES 4 ALL THE TIME

25. Do you have teaching resources in your classroom?

1 YES 2 NO

26. Rate how you like working in groups?

1 EXCELLENT 2 VERY GOOD 3 GOOD 4 POOR

5 VERY POOR

27. Do you spend more time on science than you do on other school subjects?

1 NOT AT ALL 2 SOMETIMES

3 MANY TIMES 4 ALL THE TIME

28. Do you ever miss physical science lessons?

1 NOT AT ALL 2 SOMETIMES

3 MANY TIMES 4 ALL THE TIME

29. Do you play an active role in group work in class?

1 NOT AT ALL 2 SOMETIMES

3 MANY TIMES 4 ALL THE TIME

30. How would you rate students' preparedness to co-operate during science lessons?

1 EXCELLENT 2 VERY GOOD 3 GOOD 4 POOR

5 VERY POOR

31. Are there any disruptions or interruptions during your science lessons (that is are the classes cancelled at all for some reasons)?

1 NOT AT ALL 2 SOMETIMES

3 MANY TIMES 4 ALL THE TIME

32. Does your school principal visit your class during science lessons?

1 NOT AT ALL 2 SOMETIMES

3 MANY TIMES 4 ALL THE TIME

33. Does the leadership style of your school principal influence your learning of science?

1 NOT AT ALL 2 SOMETIMES

3 MANY TIMES 4 ALL THE TIME

34. How do you rate your science teacher in terms of classroom control?

1 EXCELLENT 2 VERY GOOD 3 GOOD 4 POOR

5 VERY POOR

35. How would you rate the science teachers' knowledge in terms of content or subject matter?

1 EXCELLENT 2 VERY GOOD 3 GOOD 4 POOR

5 VERY POOR

36. How would you rate the science teachers' preparedness for lessons?

1 EXCELLENT 2 VERY GOOD 3 GOOD 4 POOR

5 VERY POOR

APPENDIX A4.2:

TEACHER INTERVIEW QUESTIONS

1. MATERIALS

Question. What materials do you have available for teaching?

What about equipment?

Do you have textbooks?

Do you prepare you own notes?

Have you tried to improvising using items from the environment?

Question. Tell me something about how you use these materials?

Are you able to include practical work in your teaching?

Are you able to give the pupils' practicals they can do or do you have to demonstrate practicals?

What do you find the best way to give notes?

Do you need to use notes much?

Textbooks are often a problem. Do you have enough? How do you use them in your work in teaching science?

2. HOW YOU TEACH

Question. What teaching methods do you use in teaching science?

Do you find these methods useful?

Do you make use of any other method?

Flexibility in class (example opportunities for learners to learn in their own preferred ways, more time for learners to learn on their own etc.) may lead to effective learning. How do you encourage flexibility in class?

In the teaching and learning process of science, do you give instructions (directions) to your students? Give reasons to support you answer.

LANGUAGE

Question. How do you approach the use the use of language for instruction and learning?

Which language is used mainly for instruction?

Are you satisfied with using it as the main language of instruction? Do you code-switch at all?

Give me an estimate of how much you code-switch?

Why do you like or do not like code-switching?

Do you allow the pupils to use both languages?

If you do, in what ways do you allow it?

Why do you like or do not like allowing the pupils to use both languages?

Question. Tell me something about your assessment procedures?

Do you give class exercises?

How often do you give homework?

Do you mark students' homework and class exercises? How do you ensure that students do their homework assignments?

How often do you administer tests?

Do you give feedback after administering a test?

Can you explain why feedback is necessary or not necessary?

Do you link classroom teaching to the way you assess your students?

Can you explain why you link or do not link assessment to classroom teaching?

Question. Can you tell me how you make use of past or previous papers?

Do you have enough past questions in your school?

Do you discuss past physical science matric. questions with students?

Can you give reasons why it is important or not to discuss past questions in class?

Are your assessment questions linked to past questions? Can you give reasons of linking or not linking assessment questions to past questions?

3. ORGANISATIONAL MATTERS

Question. Can you tell me how you organise your classroom during science lessons?

Are you able to maintain discipline in class?

What measures do you take to ensure discipline? Is discipline necessary or not necessary in classroom?

Co-operation is necessary in class. How do your students co-operate in class?

Establishing good relationship in class enhances learning. How do you do this in the teaching and learning situation of science?

4. OPEN RESPONSES

Why do you think the matric. results have been good?

Can you explain why you feel or do not feel confident and competent in teaching science?

APPENDIX A4.3:

CLASSROOM OBSERVATIONAL SCHEDULE

Date of observation.....

Name of observer.....

School.....

COMPONENTS TO BE OBSERVED

1. Materials the teacher uses to facilitate learning.

Example of materials:

(a) Chalk and talk.

(b) Textbooks

(c) Handouts

(d)Worksheets

(e) uses no materials; uses one kind of material etc.

Describe.....

.....

.....

2. Materials manipulated by students.

Example

(a) manipulated no materials

(b) few manipulated materials

(c) all manipulated materials etc.

Describe.....

.....

.....

.....

3. Use of variety of teaching methods by the teacher.

Examples teaching methods

(a) Talk and chalk

(b) Question and Answer

(c) Discussion

(d) Activity etc.

Describe.....

.....

.....

.....

4 Grouping of students

Examples

(a) whole class(no grouping)

(b) singles

© small groups

(d) large groups etc.

Describe.....

.....

.....

.....

5 Group work

Examples

(a) students sit in groups and work individually

(b) groups of students discuss problems and questions etc.

Describe.....

.....

6 Questioning by the teacher

Examples

(a) Teacher ask no questions

(b) Teacher asks few close-ended questions

© teacher ask open-ended questions

(d) teacher ask both open and close- ended questions etc.

Describe.....

.....

.....

7 students asking questions

Examples

(a) ask no questions

(b) ask simple questions

(c) Ask questions that show creativity etc.

Describe.....

.....

.....

8 Use of language by the teacher

Examples

(a) uses home language only

(b) uses English only

(c) Code-switch(use of English and home language)

Describe.....

.....

.....

9 Opportunities for students to learn

Examples

(a) students not given chance to participate

(b) only males given chance to participate

(c) only females given chance to participate

(d) Equal opportunities for both sexes to participate etc.

Describe.....

.....

.....

.....

10 Teacher notes

Examples

(a) teacher gives no notes

(b) teacher gives note through dictation

(c) Gives notes by chalkboard summary etc.

Describe.....

.....

.....

.....

11 Classroom environment (materials and resources)

Examples

(a) classroom had no charts

(b) Few charts in classroom to facilitate learning

(c) more charts in classroom to facilitate learning

(d) classroom had an OHP etc.

Describe.....

.....

.....

.....

.....

12 Teacher-student behaviour

Example

(a) no interaction between teacher and students

(b) students were very attentive etc.

Describe.....

.....

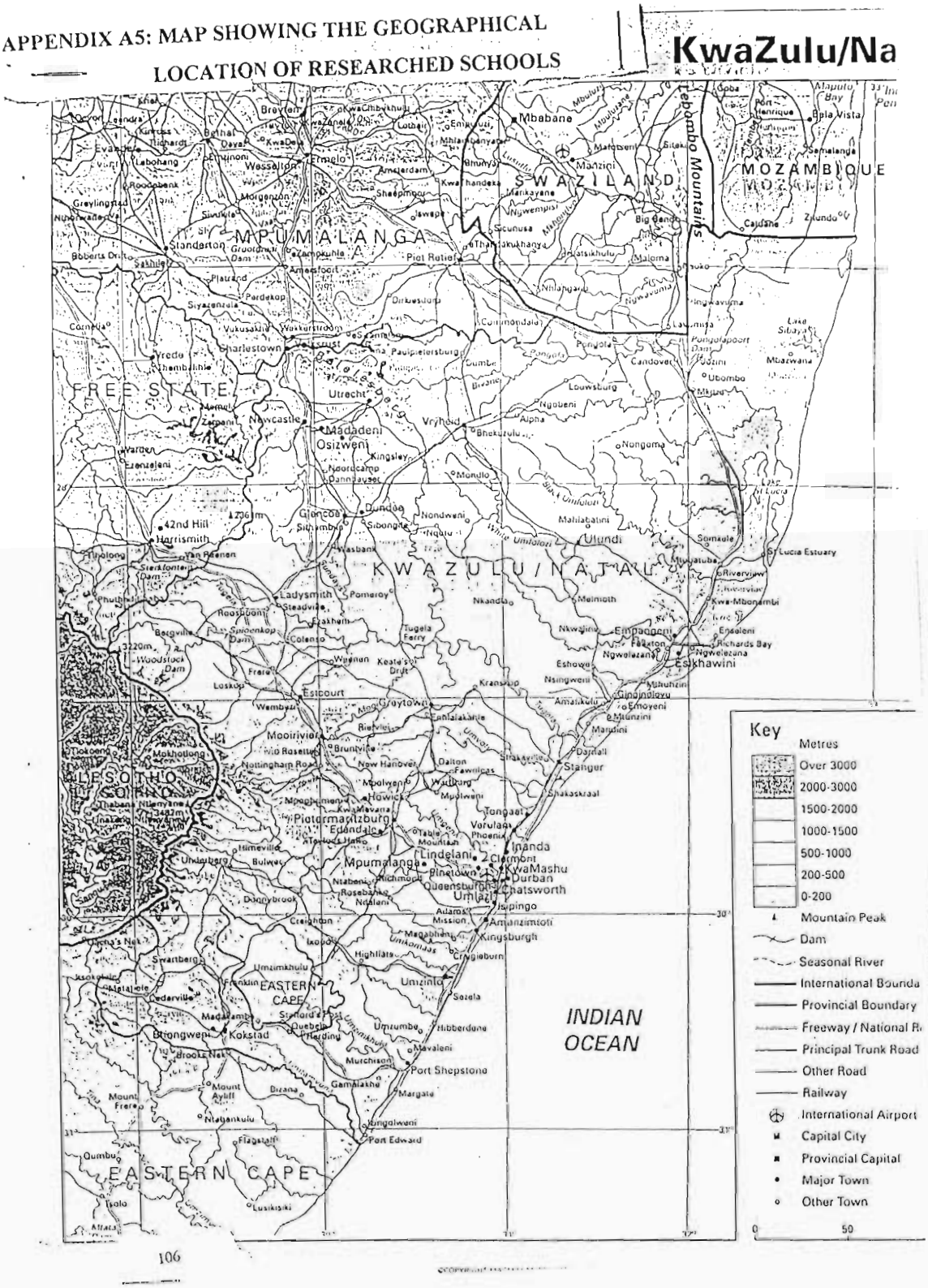
.....

.....

.....

APPENDIX A5:

MAP SHOWING THE GEOGRAPHICAL LOCATION OF RESEARCHED SCHOOLS



APPENDIX A6:

FALAZA HIGH SCHOOL

PRIVATE BAG X 6043

NONGOMA

3950

PERMISSIOM TO CONDUCT RESEARCH IN SCHOOLS

I, KOFI OTI-FRIMPONG currently teaching at Falaza High School, Nongoma have enrolled for a Masters Degree in Science Education at t5he university of Durban-Westville. The focus of my study is to investigate what factors explain the high level of science achievement in under-resourced schools, especially those in the underdeveloped areas.

I have chosen your school as one of my research schools which I intend visiting in April to capture data.

I am by this letter seeking your permission to visit your school during the course of study.

.....

KOFI OTI-FRIMPONG

(REGISTRATION NO: 9804543)

APPENDIX A7:

SCHOOL BOYS IN A CLASS OF THEIR OWN

NEWS ANALYSIS

Sunday Times, June 29 1997

Schoolboys in a class of their own

latric examination results show girls are less likely to get gold stars than their male classmate

STEY

; came second to boys in last year's matric exams, chal-
ing common perceptions and raising questions about the
sures that hinder their academic development.
ls than boys wrote matric in each province last year, but
ally fewer girls than boys passed. Fifty-six percent of full-
dates were female and 50.2 percent passed; 44 percent
and 58.5 percent passed.
rent? Little data is available and principals interviewed by
Times had not considered the results in gender terms.
, matric results for 1993 divided into gender and race.
white girls and boys had more or less the same pass rate of close to 100 percent. More white girls than boys passed with exemption, but only 28 in 100 black girls passed.

Ann-Marie Wolpe, who heads the government's education gender equity task team, says regions and social class have to be taken into account.

"In the UK, middle-class girls are doing better than ever. I'm sure studies would show white rural girls here are not doing well, while Indian girls at Indian schools are doing much better."

...st pupils ...ss over ...cience ...d maths

...science is one of the ...lar matric subjects. ...in 100 full-time candi... ...ose science last year ...with almost 30 in 100 ...iology.

...nationally scored well ...subjects: 67 percent ...ence and biology had ...e of over 50 percent.
...matics is also not a hot ... Only 41 out of every ...s wrote the exam and ...han half passed.
...stern Cape scored best ... Just over half its ...ose it as a subject and ...nt of them passed. The ...essful was the North... ...nce where only 32 in ...s chose maths and 21 ...of these passed. Only ...00 higher grade candi... ...he province passed.
... choices and success ...r between provinces. ...was tackled with ease, ...e to a 55 percent pass ...nwide.
... the national pass rate ...s 54.7 percent. Ranked ...f percentage pass rates ...ern Cape 80.2; Northern ...1; North West 69.6; ...Natal 61.8; Gauteng ...e State 51.1; Eastern ... Mpumalanga 47.4 [illegible]

"Research has shown that single-sex schools are the environment in which girls shine."

Dr Jane Holmeyr, a policy adviser on education and training to the National Business Initiative, says: "If you have a daughter and you want to give her the best chance in life, send her to a girls' school. They don't come out with the perception that girls can't do it."

Sarah Pinchuck, a matric pupil at Victoria Girls' High School in Grahamstown, says her art classes, attended by boys from Graeme College, are a different experience. "It sounds ridiculous, but I work harder when I'm with the girls. At art, we're so excited we just want to talk and get to know each other. It's hard to concentrate," she says.

Ellen Kondowe, the principal of Letsibogo School for Girls in Meadowlands, Soweto, says: "Girls don't do well because of boys. They get confused and excited when they fall in love and, although it helps in a way that boys are not around at school, we can see it clearly when they fall in love. They become giggly, they are aware of themselves and they daydream."

Falling in love in one's teens is hardly an exclusively female practice, but there are other reasons why girls are performing dismally.

Kondowe says there is a high rate of pregnancy among her pupils. Pregnant girls return to school after giving birth, but they have a split focus.

Mzwandile Hewu, the headmaster of Luhlaza Senior Secondary in Khayelitsha in the Western Cape, says boys have more time to study.

"In the African community, girls play the roles of mothers. They have goals and vision, but there are barricades — they have to make food, clean the house and iron as they don't have helpers at home and their parents leave for work at 5am and come home after 5pm."

Some educationists speculate that girls' poor performance is merely a result of the quality of those girls who reach matric.

Peter Moore, the headmaster of Stirling High School in East London, says it is possible those boys who might have failed have already left the system.

Margie Probyn, a teacher at Langa Comprehensive in the Western Cape, says girls tend not to get involved in gangs and hijackings, activities that could turn them into dropouts.

Research shows that unlike children in many African countries, South African girls and boys have equal access to schooling. But the fact that more girls stay until matric is a uniquely Southern African phenomenon, recorded both here and in Botswana. It has been noted in South Africa only since 1976, a year marked by student uprisings and the subsequent exodus of many schoolboys.

But Holmeyr says the Botswana evidence shows the predominance of girls in matric is not due to apartheid alone.

"In many areas, especially rural, educated girls attract a higher *lobola*, so there the girls will tend to stay at school.

"Girls underachieving is a common problem. Many bright girls fear they'll be seen as nerds or boffs and won't get dates."

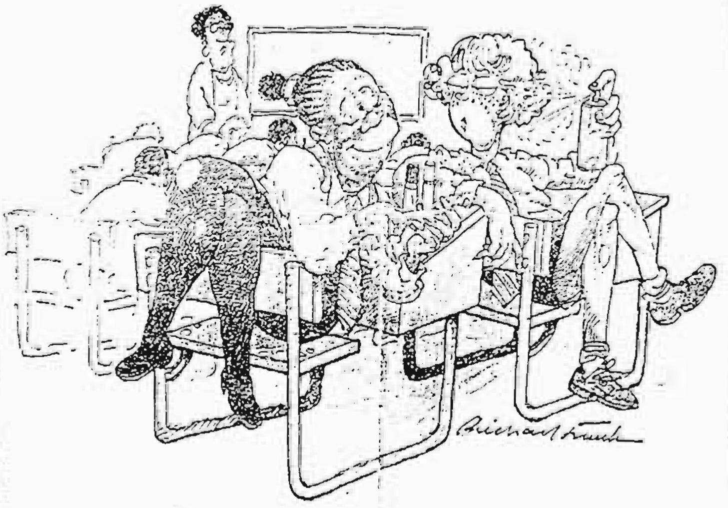
Cultural factors aside, it is what happens inside the classroom that is the most telling.

Holmeyr says most teaching favours boys. "Boys learn better individually, the typical way most classes work, and girls work better in small groups."

A London University study of teachers in action shows that, even if they are aware of being observed for the amount of attention they pay to boys, they still devote more time to them and respond to them first.

Dr Shirley Kokot, the director of Radford House in Johannesburg's northern suburbs and a Unisa lecturer, says girls' status and self-confidence is affected by little things, like teachers calling boys' names first in a roll call.

But give girls a chance and they thrive. Abigail Abrahams, a teacher at Oval North in Mitchells Plain in the Western Cape, says the top students at the school who are studying to be electricians and motor mechanics are female.



APPENDIX A8:

TEACHER INTERVIEW RESPONSES

A8.1 RESPONSES FROM BANZANA HIGH

1. MATERIALS

QUESTION. What materials do you have available for teaching?

As at now we have textbooks but in the case of equipment we have few.

Do you prepare you own notes?

Hmm, yes, I prepare my own notes.

Have you tried to improvised using items from the environment?

I don't use items from the environment.

QUESTION. Tell me something about how you use these materials?

Okay! Concerning the use of these materials what I do is, I read from the textbooks and summarise everything and give to my students.

Are you able to include practical work in your teaching?

Eh!! In the case of practicals I don't use them or include because equipment is not available.

Do you demonstrate practicals?

Um! Sometimes I try to demonstrate practicals.

What do you find the best way to give notes?

Eh! In the case of giving notes, I use the chalkboard.

In what form do you use the chalkboard?

Good. I use the chalkboard to summarise notes.

Do you need to use notes much?

No, I don't use notes too much.

Textbooks are often a problem. Do you have enough?

Okay! In our school, we have enough textbooks. At least each student has one.

How do you use them in your work in teaching science?

In that case eh!, I read the textbook and summarise them.

2. HOW YOU TEACH

QUESTION. What teaching methods do you use in teaching science?

I use the telling method.

Do you find this method useful?

Hmm! It is not useful as such since there is no practical work.

Do you make use of any other method?

Eh! I also use discussion method.

Are these the only methods you use?

Yes.

Flexibility in class (example opportunities for learners to learn in their own preferred ways, more time for learners to learn on their own etc.) may lead to effective learning. How do you encourage flexibility in class?

In term of flexibility I usually allow the class to use group method whereby they do discussions among themselves.

In the teaching and learning process of science, do you give instructions (directions) to your students? Give reasons to support your answer.

Oh! Yes, I give classroom instructions to my students. I give them direction to try and get to what I wanted.

QUESTION, Tell me something about your assessment procedure?

Well, concerning assessment I usually give them class exercises to know whether what has been done was understood. After some time, I give them test.

How often do you administer tests?

Once in a week.

Do you give feedback after administering a test?

Yes, I do give feedback.

Can you explain why feedback is necessary or not necessary?

Feedback is necessary because I usually do it so that the students can know of their mistakes. At the same time it also serves as a revision.

Do you link classroom teaching to the way you assess your students?

Yes, I do link classroom teaching to assessment.

Can you explain why you link assessment to classroom teaching?

I link to classroom teaching just to see whether I achieved the objectives of my lesson

You say, you do give class exercise. How often do you give class exercise?

Precisely, three times in a week.

How often do you give homework?

Once in a week.

Do you mark students' homework and class exercises?

Sometimes I mark their exercises and sometimes they themselves mark. But not by themselves but by their fellow students.

What are you trying to say, "but not by themselves but by their fellow students"

Okay! I mean they exchange their exercises and each student does not mark his or her own work.

How do you ensure that students do their homework assignments?Usually, do you know, I force them. If they don't do it I punish them.

QUESTION. Can you tell me how you make use of past or previous papers?

I make use of past previous questions so that my students will know how to answer questions and how they set questions.

What do you mean by this? Do you mean to say, you discuss past physical science matric. Questions with students or what?

Yes, this is the point I want stress.

Can you give reasons why it is important or not to discuss past questions in class?

Eh! It is very necessary discussing past questions in class for the two reasons:

1. It show students how the questions have been set
2. It gives them idea on how to answer questions

Do you have something more to say in connection with this?

No, these are my two reasons.

Are your assessment questions linked to past questions?

Yes, most of my assessment questions are linked to past questions.

Can you give reasons of linking assessment questions to past questions?

Yes, I discuss questions with students just to let them know the types of questions set, thus the approach used in setting questions.

Okay! Thank you. Do you have enough past questions in your school?

We don't have enough past questions usually I organise them from other schools.

QUESTION. How do you approach the use of language for instruction and learning?

Okay! I use English language.

Are you satisfied with using English as the main language of instruction?

I am satisfied of using it as the main language of instruction.

Why are you satisfied with it?

Because the questions are usually in the English language.

Which questions are talking about?

Hmm! I am talking of the matric.

Do you code-switch at all?

No, I do not code-switch.

Why do you not like code-switching?

Because I don't understand the Zulu language.

Is this the only reason you can give?

Do you allow the pupils to use both languages?

No

Why don't you allow the pupils to use both languages?

Because I want them to be used to English as their examination question is in English.

3. ORGANISATIONAL MATTERS

QUESTION. Can you tell me how you organise your classroom during science lessons?

In terms of classroom organisation what I do is that at times I group the students.

Are you able to maintain discipline in class?

Yes, I do maintain discipline in class.

What measures do you take to ensure discipline?

The measure I take is whoever does the wrong thing is punished.

Is discipline necessary or not necessary in classroom?

Discipline is very necessary classroom because if there is no discipline you can never achieve your objectives.

Co-operation is necessary in class. How do your students co-operate in class?

Okay! In terms of co-operation in class students always discipline themselves.

Establishing good relationship in class enhances learning. How do you do this in the teaching and learning situation of science?

I promote good relationship in class, this helps them just because I allow students to be free and ask questions on their own.

4. OPEN RESPONSES

Question. Why do you think the matric results have been good?

Okay, eh! The results in my school have been good since there is discipline in the school. This has helped the school a lot for the past 5 years.

Is that all you can tell me why the results have been good?

What I have seen is that discipline is a very important factor because if there is no discipline the children can not learn well.

So is it only discipline that has helped the results to be good?

From my point of view the school I teach now is not the only school I have taught. I have taught in many schools and I have seen the difference. That discipline is very important, without discipline the children would not like to learn.

Can you explain why you feel or do not feel confident and competent in teaching science?

I feel confident and competent in teaching science just because I have been trained for it and so I don't see why I don't feel competent and confident.

APPENDIX A8.2:

RESPONSES FROM HAMU HIGH

1. MATERIALS

QUESTION. What materials do you have available for teaching?

Eh! Materials, hmm, let me say we have textbooks and set of books even though they are not much for the use of few groups. This is an example. And the second is produced materials from Sowetan by William Smith. Every Friday I make sure I buy the Sowetan and my learners also buy the Sowetan. I also use previous exams' questions. That is, so, here I have a variety of the papers for the High Grade and a variety of the Standard Grade papers. Here I make sure I answer all questions and work it.

What about equipment?

All right, a good question too, eh! Concerning equipment, we are very under-resourced. I must mention on that. But we have very few materials in the laboratory, especially in chemistry. Whenever we are in difficulties we try of course to improvise the T.V and also make visits to nearby schools for equipment because we don't have them here.

Okay, let me know. Do you prepare your own notes?

Yes, that is, I compile my notes from the Sowetan and information that I get from William Smith's programme.

Have you tried to improvise using items from the environment?

Yes, I do improvise. Because we don't have enough materials. I make use of teachers from surrounding schools and inviting teachers. I also use to take my own T.V to the school whenever necessary.

So, what are some of the materials you have tried to improvised?

Eh! Our school hasn't this T.V so I use to bring my so that I can help my learners.

Ooh! Let me put the question this way. Have you improvised using items for the environment in place of sophisticated and imported materials?

Yes, I have improvised a lot for example using the paraffin stove in place of "Bunsen burner"

QUESTION. Tell me something about how you use these materials?

Thank you very much. We are very much interested in William Smith's programme. So, every Thursday and Friday I make my T.V available in the school for the science class to observe William Smith's lessons. We use textbooks also to supplement this. Thus, my learners use textbooks after experiencing problems.

Are you able to include practical work in your teaching?

Yes, even though as I have said about materials and equipment they are not available, but I try, I try to use the very limited resources for practicals. But when I see that it is impossible, we pay visits to other schools for practicals. But I must make it clear it is very impossible to do all the practical work. Here I am saying that very few of them(practicals) are done.

Are you able to the pupil's practicals they can do or do you have to demonstrate practicals?

No! I make sure eh! Whenever there is something to be done practically, I make sure that they do it and I am only there to find out and observe

how they are performing, which means that I never help them unless they are in problems.

What do you find the best way to give notes?

Eh! You see as I am teaching I don't give notes too much. I give chalkboard summary. Learners take essential points as teaching goes on. That is, they take notes as a chalkboard summary.

Textbooks are often a problem. Do you have enough?

Not available. As I mentioned, they are not available. But those that are available I make sure that we use them effectively to complement my teaching.

2. HOW YOU TEACH

QUESTION. What teaching methods do you use in teaching science?

Eh! Let me tell you, I rely on using the question and answers.

Do you find this method useful?

Yes, eh! I find it useful for a number of times. You see, whenever I give a problem I rely on question and answers. It is only in groups where I use to give questions for group members to discuss and one will present for the group.

Do you make use of any other method?

I use to try.

What do you use to try? The question is, do you use any other method in teaching science aside the question and answer method?

Yeh! Yeh! I change methods. Whenever I am introducing a lesson for the first time, I teach them the key points and secondly give them

information and ask questions. And thirdly, I make sure that in my teaching, I make them discuss.

Flexibility in class (example opportunities for learners to in their own preferred ways, more time for learners to on their own etc.) may lead to effective learning. How do you encourage flexibility in class?

Well, I use to allow my learners whenever I am discussing with them. Firstly, to forward their views, let me say when we are discussing. Then when it comes to teaching I allow them to suggest methods. Also, I use to give them chance discussion and how they like their feelings to be conducted.

In the teaching and learning process of science, do you give instructions or directions to your students?

Yeh! I do so when I am going to introduce the lesson for the first time. This is to say, I use to give them directions but at times, I make sure I allow the pupils to investigate on their own.

Can you give reasons for allowing pupils to investigate on their own?

My aim is I want them to become critical thinkers. Eh! I want them to become inquisitive about science and find things on their own but not "spoon feeding" them.

Question. Tell me something about your assessment procedure?

My assessment is in two ways. Firstly, whenever I have gone though a topic for example "momentum" I give assignment, then I give a feedback and do analysis of results-which means those who score high, average and those who score low marks. I then group my students in their ability groups based on the analysis of the test results and assist each group.

Then my second assessment is based test. After completing every unit of course content I give my pupils test. If I observe that their performance is below my expectation, I re-test them on the same unit. By so doing, I have seen that my pupils are able to improve.

Do you give class exercises?

Every day or during the lesson I give class exercise to find out if they have understood the lesson.

How often do you give homework?

I make sure I give the homework every day to occupy them.

Do you mark student's homework and class exercises?

I do so, involving my pupils together in class. Thus, when discussing the homework or exercise, I provide the solution on the chalkboard and students do the marking. However, I make sure that students do not mark their own work.

How do you ensure that students do their homework assignment?

Fine. During discussion and marking, I am able to identify passive learners. I later call them, we sit down and advise them strongly.

How often do you administer tests?

Every week I give my pupils' tests. I do analysis of the test to identify those who score above average, average and below average. I then call pupils in various groups together and discuss problem areas.

Okay! Your response to this question also implies that you give feedback after administering a test. Can you explain further why feedback is necessary or not necessary?

They are necessary because I can identify weaknesses and discuss learners' weaknesses.

Do you link classroom teaching to the way you assess your students?

Yes, my assessment is based on what I do with learners.

Can you explain why you link assessment to classroom teaching?

I am interested in testing if what has been done in class is understood. That is, if the lesson is successful.

Question. Can you tell me how you make use of past or previous papers?

I use previous papers for the 10 different Departments. What I do is, I answer questions on the same topic from all the different Departments. For example, if I take Newton's laws, I find solutions to all questions on Newton's laws from the previous papers I have from the different Departments and discuss each question with my learners.

You are trying to tell me that you discuss past physical science matric questions with students. Can you give reasons why it is important or not to discuss past questions in class?

It is important for discussing past questions. Learner will be in a position to know what is expected of them. They get to know the general trend and allocation of marks. They also get to know styles of setting questions and how to respond or answer questions in examination.

Are your assessment questions linked to past questions?

I link my assessment to previous questions.

Can you give reasons of linking assessment questions to past question?

Just to train them and assist them to be used to answering "standard questions" and also to "time-speed" my learners.

Do you have enough past questions in your school?

No, past questions are not enough in the school. Learners also don't have enough. They have few.

Question. How do you approach the use of language for instruction and learning?

I make sure I use the official language. I never use the local language.

Which language are you referring as the official language?

Official language here is English. However, when pupils are responding to my questions, I allow them, I allow their responses in Zulu. Whenever I teach, I teach in English and their responses, I allow in Zulu.

Are you satisfied with using English as the main language of instruction?

Yes, to motivate them to be used to the English language.

Do you code-switch at all?

Yes, I do but, but it does not help. I only code-switch when we are sharing information and discussing, so I code-switch.

Why do you like or do not like code-switching?

No! I do not like to code-switch when teaching. Yeh! You see for one reason. I know that the questions in examinations are in English so is a way of allowing pupils to stick to English language.

3. ORGANISATIONAL MATTERS

Question. Can you tell me how you organise your classroom during science lessons?

Well, in the case of classroom organisation, my pupils are always seated in groups and I ensure that there is space enough space between groups. Each group faces the chalkboard and no group is seated behind another group.

Are you able to maintain discipline in class?

Yes, I ensure that there is discipline in class. I have trained my pupils and they are able to discipline themselves even in my absence.

What measures do you take to ensure discipline?

I don't allow the students to work individually. They sit in and do their work. I assign a group leader in each group and in groups they discipline themselves.

Is discipline necessary or not necessary in classroom?

Discipline is very essential. Because without it pupils can not cope with lessons.

Co-operation is necessary in class. How do your students co-operate in class?

Yes, co-operation makes work to be easy. Students share ideas and solve questions quickly and there is the spirit of working together. However, I must say, not all of them are co-operative. About 40% do co-operate. I am hoping that with time a greater number of them will co-operate.

Establishing good relationship in class enhances learning. How do you do this in the teaching and learning situation of science?

I discipline pupils but do not discourage them. I hold discussions with them on how they need to work and on how they need to take science seriously.

4. OPEN RESPONSES

Question. Why do you think the matric results have been good?

The results have been good due to co-operation, dedication and positive attitude in class. I establish this from the start of the year. I plan a working program follow it strictly so that we don't lag behind.

I also ensure that learners keep pace, provide immediate feedback and no absenteeism. I again ensure that there is frequent testing and learners mastering topics.

Question. Can you explain why you feel or do not feel confident and competent in teaching science?

I feel confident in teaching. I like the subject and I am proud of it as my learners are able to respond frequently when teaching. My learners are able to compete among themselves and with other neighbouring students. In this way, I am able to assess myself as been competent.

APPENDIX A8.3:

MANGWAZANA HIGH SCHOOL

1.MATERIALS

What materials do you have available for teaching?

Some textbooks and some equipment.

Do you prepare your own notes?

Yes, I do by combining two or three textbooks.

Have you tried to improvised using items from the environment?

At times I do use items from the environment depending on the topic I am treating. For example, I use the wheelbarrow to explain ticker timer whereby a student will be pushing the wheelbarrow and another student with stones will be dropping them at time intervals. I have also been using the football field to explain electrical field or magnetic field.

Question. Tell me something about how you these materials?

The textbooks are used for preparation of notes and making sure they have been summarised to the best of the knowledge of students. The equipment is used for experiments where necessary like the ticker timer.

Are you able to include practical work in your teaching?

At times I do with the few available equipment.

Are you able to give the pupil's practicals they can do or do you have to demonstrate practicals?

Well, due to of equipment I demonstrate practicals myself as my students watch.

What do you find the best way to give notes?

Okay, by using the chalkboard, teaching and giving them notes at the same time by way of explaining.

Do you need to give notes too much?

No. Firstly, just a short note as I explain with the points. Thereafter they do the rest themselves.

Textbooks are often a problem. Do you have enough?

Yes, because each student has at least one physical science textbook.

How do you use these textbooks in your work in teaching science?

After explaining and giving them notes, they refer the textbooks for further explanations.

2. HOW YOU TEACH

QUESTION. What teaching methods do you use in teaching science?

I use the question and answer and discussions.

Okay, let me know if you make use of any other method?

Yes, I also use demonstration method at times.

Do you find these methods useful?

Yes. I find them useful.

Flexibility in class (example opportunities for learners to learn in their own preferred ways, more time for learners to learn on their own) may lead to effective learning. **How do you encourage flexibility in class?**

I encourage them to things on their own such that it will stick in their heads.

In the teaching and learning process of science, do you give instructions (directions) to your students?

Yes. When I give them some work to do, I go round and give the necessary directions to those with problems

ASSESSMENT

Question. Tell me something about your assessment procedures?

I assess students with class work, tests and some little homework (just to keep them busy at home). I don't give enough homework because they will be doing copying work from each other or asking other people to do it for them.

Do you mark student's homework and class exercises?

Oh, Yes.

How do you ensure that students do their homework assignments?

I do so by asking them to open their exercise books for inspection as I go round. Any student who fails to do it, I send him out of the class to go and do it.

How often do you administer tests?

I give test every month.

Do you give feedback after administering a test?

Yes. I give feedback to allow the students to know of their mistakes.

Do you link classroom teaching to the way you assess your students?

Yes.

Can you explain why you link assessment to classroom teaching?

Well, just to assess if their performance and responses in class reflect their assessment marks.

Can you tell me how you make use of past or previous papers?

Okay. After treating a topic I use past questions in solving problems for the students to know the trend or pattern of the questions.

Do you have enough past questions?

Well, I have got the past questions for the years 1994 to 1998.

Are your assessment questions linked to past question?

Yes, to show students how the questions are set.

3. LANGUAGE

Question. How do you approach the use of language for instruction and learning?

I use English.

Are you satisfied with using English as the main language of instruction?

Yes. Because the questions are being set in English at the end of the day.

You said the questions are being set in English. What questions are you referring to?

I mean the matric questions and the monthly and quarterly test questions.

Do you code-switch at all?

No.

Why do you not like to like code-switching?

Just for two reasons. Because I am not a Zulu and also as their questions are being set in English they must be used to English.

4. ORGANISATIOAL MATTERS

Question. Can you tell me how you organise your classroom during science lessons?

Actually I have not introduced them group work. I now have to assess them well and group them so that the low achievers will not be in one group and the gifted ones also in another group.

Are you able to maintain discipline in class?

I make sure there is discipline and silence in class.

What measures do you take to ensure discipline?

The class captain makes sure that the class is quiet and he writes down the names of those who will be disturbing for them to be punished.

Co-operation is necessary in class. How do your students Co-operate in class?

Students co-operate by helping on another in their work. They also co-operate by responding to questions in class.

Establishing good relationship in class enhances learning. How do you this in the teaching and learning of science?

I give the students the chance to ask questions and when goes wrong I correct the student. Again, if they don't have questions to ask, I throw to them questions to see how best they understand the topic.

5. OPEN RESPONSES

Question. Why do you think the matric results have been good?

Because the students have been opened to past questions, effective teaching and have been trained in English so they read and understand the questions.

Fine. Is that all you can say to support why the results have been good?

Also they are kept after school for one and half hours for three times a week for them to do their private studies while the teachers supervise. In the course of these time students with problems in specific areas have the chance to approach the physical science teacher.

Can you explain why you feel or do not fell confident and competent in teaching science?

I feel competent and confident in teaching the subject physical science because I know what I am doing and like the subject. I was born to be a physical science teacher.

APPENDIX A8.4:

RESPONSES FROM BHOKWE HIGH

MATERIALS

QUESTION. What materials do you have available for teaching?

Well, we have eh, even though not enough materials in this school. But we have at least bits and pieces of materials for particular experiments. We do have the trolleys. We also have the ticker timer. When it comes to chemicals, we have a lot that we use for our experiments. For instance when we do the rates of chemical reactions we have a vast number of these chemicals and also when we do the equilibrium we also a vast number of chemicals. But when it comes to other chapters that I have not mentioned, we do not have enough materials. So I can say we are very much under-resourced giving the situation that even we don't have a laboratory in the school. All we have is just what is packed in one cupboard. As at now, we are busy trying to persuade the Government to buy us some more materials so that we will be able to teach these kids efficiently and effectively.

Okay, thank you. Do you have textbooks?

Well, hmm!!! Last year we had textbooks but unfortunately this year we don't have enough. Some of these books were stolen when thieves broke into our staff room. The textbooks I use often are the Physical Science in Action, Physical Science 2000 and the other one is the Senior Physical Science. So, these are the books I make use of and I find them to be very good towards teaching.

How do you make use of the few available textbooks?

Well, what I often do is when I go to class the students sit in pairs exercising sharing. They share the books, they compare what is in the book with what I teach. When they go home, if student A has used the

book today, then the next day it will be student B. When I give them some work which is in the book they do it after school because no can afford not to do the work.

Fine, okay. The next probing question is, do you prepare your own notes?

Yeah! Yeah! I do prepare a day before I go for that lesson. But what normally happens is, when I go class I know what I have prepared and I don't refer to the notes because I think that it limits the confidence as well as the creditability of the kids whereby you to refer to the books most of the time. You must have your lessons thoroughly prepared and that is what I do. I prepare my lessons thoroughly and when it comes to giving notes, I don't give them notes. What I normally do is, as I am teaching they listen and write. This is the skill I have thought them. I want them to be very good in this because it is the most skill that is used at the universities at this point in time.

Thank you. Let me know if you have tried to improvised using items from the environment?

Yeah! Yeah! When it comes to improvisation we try to improvise a lot. As I have said earlier, we don't have enough materials so sometimes you find yourself using materials that are not meant for the experiment but they serve the same purpose. Well, that is, on my side is very good because it strengthens the knowledge of the child. It doesn't limit it to what is written in the book.

Thank you very much. Now, can you tell much about how you use these materials?

Well, hmm! The fact that we have at least 30 or 35 minutes for each period per day or one hour ten minutes for a double period one can not perform experiments with that given time. So what I normally is I

conduct most of my experiments after school so as to give me ample time to have all the materials ready. I perform the experiment in front of the class. When I perform the experiment I don't allow them the students to sit down. They come around the table as I start doing the experiment. Whilst I am performing the experiment, I involve them. They must do the holding and the pouring if there is the need. Thus, they must they must do something towards the experiment that makes them to be part of the experiment.

Now, what do find as the best way to give notes?

Hmm! As I have said I don't give notes because is time consuming. Hmm! Because they have books, what I have trained them is, they must listen and write at the same time since this is a perfect skill for them to cope at the university level.

HOW YOU TEACH

QUESTION. What teaching methods do you use in teaching science?

Oh, I do not use one simple or specific method. I use more than one interchangeably. I use the lecture method when there is a need. I also use the experimentation method and sometimes I use the discovery.

Do you find these methods useful?

Yes, they are very effective looking at the situation that last year all my science students passed matriculation physical science in spite of all the constraints that the school is a rural school.

Flexibility in class (example opportunities for teachers to learn in their own preferred ways, more time for learners to learn on their own etc.) may lead to effective learning. How do you encourage flexibility in class?

Well, sometimes other than me teaching, I let the kids work in groups. For instance say, group A should treat chapter so and so and group B to treat chapter so and so. They divide the chapter among themselves as a group. The following day, group A will present what they have prepared and the next day group b will also present and I wind-up the two chapters and summarise everything.

In the teaching and learning process of science, do you give instruction (directions) to your students? Give reasons to support your answer.

Yeah! For sure that is what I'm there for. To give directives especially you know in my class we work as a family. I am the father of the class that is my family.

LANGUAGE

Question. How do you approach the use of language for instruction and learning?

Often I use English because even the books used are written in English. But there are cases where I have to explain in Zulu so that the kids can actually understand.

Do you find the use of English to be useful?

Very useful. You know, sometimes when you explain something in Zulu and you don't explain in English kids will have a problem constructing English to give what has already been explained.

ASSESSMENT

QUESTION. Can you tell me something about your assessment procedure?

Well, to assess my pupils I use classroom exercises and assignments. I also give test on monthly basis to assess whether what I've taught has been understood.

Fine. How often do you give homework?

As for homework is something the kids have to get daily. Even if I forget to give them homework, they remind me that hay, you have forgotten to give us homework.

Do you mark student's homework and class exercises?

Oh, yes. I do that but mostly I find it very easy to have them mark their work and I just endorse my signature. What I do is, I give them homework and the following day I check whether the homework has been done. Having done that, we solve the problems in class. As I solve the problems they also do the marking.

How often do you administer test?

Anytime I finish a particular chapter I give test. So it is not a matter of weeks or months. It depends on how soon I finish the chapter.

Do you give feedback after administering a test?

Yes. I've found that to be very effective because when you give a test one has to give a feedback to make it clear to the kids that you were so many "miles away" form the correct answer.

Thank you very much. Okay, do you link classroom teaching to the way you assess your students?

Oh, yes. I often find it to be something you can not divorce from teaching and assessment. You know, if you assess, you assess in order to find out whether what you have taught has been understood.

Can you tell me how you make use of past or previous papers?

I have a collection. When I use these previous papers, the kids not only enjoy the problems in that particular paper but they discover the style of setting of questions. Also, the questions that are in the previous exams' papers help to maintain standards. Because sometimes you find that a teacher is very good in teaching "standard" grade but when the kids write, they don't write "standard" grade. They write both "standard" and "higher" grades and those writing "higher" grade encounter problems in attempting the questions because they are only limited to "standard" grade questions. So it is very imperative for each an every teacher when teaching to continuously make effective use of previous exams' papers and solve those problems.

Okay, you said you have a collection of pat papers. Are they enough in your school?

I think they are enough but I am in short of the memos. For example, I don't have the 1994 physical science memo. But you see in "physics" it is important to have a "memo".

Are your assessment questions linked to past questions?

Yes exactly. Because I want my kids to aware of the types of questions the examiners set.

ORGANISATIONAL MATTERS

question. Can you tell me how you organise your classroom during science lessons?

Well, I often stand in front of the class to enable me notice any misbehaviour or inattention in class. But sometimes I organise in groups and move around to help each group.

Are you able to maintain discipline in class?

Very much, because when I am teaching I keep my eyes wandering around the class so it is very easy to detect any person who is misbehaving. Whenever I get a culprit I send that person out of class. But I don't often do that since I don't like using one method. Because if I adopt one method as my tool the kids will be used to it and they will take it for granted. So I interchange my methods of dealing with misbehaviour-sometimes it depends on the type of misbehaviour. There are those minor inflicting misbehaviour which one must ignore because they draw attention. Sometimes it happens that a kid can just misbehave

just to draw your attention or the attention of the class. So as a tool if you ignore him it makes him bitter and stops doing that.

Is discipline necessary or not necessary in classroom?

Yes, obviously everywhere we have to discipline for any structure that exist-be it organisational structure or family structure. Because discipline is necessary everywhere especially when you deal with kids.

Co-operation is necessary in class. How do your students co-operate in class?

Well, my students are very much co-operative because they have been motivated. Hmm, to earn co-operation from students, you have to motivate them first. My students do co-operate for example if I instruct them to bring something in class, to show their co-operation they bring them. Also if there is a workshop, they make sure they attend. Again, if I tell them we should have extra classes after they do attend.

Establishing good relationship in class enhances learning. How do you do this in the teaching and learning situation of science?

They are free to ask questions and make additional consultations after the lesson.

OPEN RESPONSES

Why do you think the matriculation results have bee good?

My students are motivated and co-operative in the first place. Secondly, I'm confident and think I'm a good teacher myself and have love for my lessons as well as my kids.