# Grade 9 Learners experiences of the Common Tasks for Assessment in Mathematical Literacy, Mathematics and Mathematical Sciences

**By**

**Mumtaz Begum Khan**

**(202523846)**

**Supervisor**

**Dr S. Bansilal**

Submitted in partial fulfilment of the academic
requirements for the degree of
Master of Education in the
School of Science, Mathematics, and Technology Education
Faculty of Education
University of KwaZulu-Natal

December 2008

# ABSTRACT

This was a qualitative study carried out with one Grade 9 MMLMS class. The purpose of the study was to explore the experiences of the learners with respect to the CTA that they completed for their summative assessment. The methods of data collection were classroom observation, document analysis and interviews. Data was gathered from 4 classroom observations, a document analysis of the 2005 CTA instrument, the detailed responses of 3 learners to the CTA as well as a focus group interview with the 3 learners. The document analysis was done against a framework of moderating criteria identified by the moderating board of the CTA. The 4 lessons were video taped while the researcher was a participant observer in the classroom. The transcription of the tapes, the field notes and observation schedules were analysed with the intention of providing answers to the main research question. Similarly the interviews were video taped, transcribed and then analysed to provide further insight into the research question. Finally the learners' responses to certain items were scrutinized for further details. The findings revealed that the task design, which relied on grounding each task within one context, was problematic for the learners. The learners struggled with the language used in the tasks and often could not pick out crucial information from all the details associated with the contextualization. The language of the tasks was set at a high level of readability, higher than the average Grade 9 level. Furthermore, the teacher's interventions often seemed to hinder rather than facilitate their understanding of the mathematics. The results of the study have implications for teachers (to be careful of how they mediate the tasks), curriculum developers (to take note of the criticisms levelled at assessment tasks set in real life contexts) and mathematics educators (to voice their concerns about national assessment instruments which may themselves not be valid indicators of what learners can and cannot do).

# PREFACE

The work described in this thesis was carried out in the School of Science, Mathematics and Technology Education, University of KwaZulu-Natal, from **January 2005 to December 2008** under the supervision of **Dr Sarah Bansilal** (Supervisor).

This study represents original work by the author and has not otherwise been submitted in any form for any degree or diploma to any tertiary institution. Where use has been made of the work of others, it is duly acknowledged in the text.

**Mumtaz Begum Khan**

**December 2008**

14/01/09.

# TABLE OF CONTENTS

# LIST OF TABLES

# LIST OF FIGURES

## ACKNOWLEDGEMENT

With the deepest gratitude I wish to thank every person whom have assisted me and without whom I would not have been able to complete this dissertation.

Thanks to my supervisor Dr Sarah Bansilal for her constant supervision and support from the beginning of this research study to the final presentation of this thesis. I am grateful to Sarah for walking with me through this journey and inspiring me and generously sharing her wisdom with me and helping me move from darkness into light.

I am grateful to my colleague and her learners whose experiences with the CTA helped shape this thesis.

Thanks to my school Principal, Governing Body, Department of Education and parents for granting me permission to conduct this study.

Thanks to the University of KwaZulu-Natal for a bursary, The NRF for funding from The Thuthuka Project (Administered by Dr S. Hobden – Reference No: GUN2063963), and The Thuthuka Project (Administered by Dr S. Bansilal – Reference No: TTK2007051900)

Thanks to my precious friend Pam Pillay for her constant love, support and encouragement during trying times.

I am grateful to my mother whose love and support knows no limits, and in memory of my father whose love continues to shine through my life, and the rest of my family for their constant support and encouragement to complete my studies.

I am grateful to God for affording me the opportunity to study and giving me the strength and guidance to complete my studies.

## Dedication

To my parents, Ahmed Basheer Khan and Fathima Bibi Khan

My parents gave me the greatest gift any parent could give their child, they believed in me.

# CHAPTER 1

# INTRODUCTION

In this chapter I briefly discuss the background, rationale and purpose of the study.

## 1.1 BACKGROUND OF THE STUDY

Since 1994 South Africa has experienced many changes. One of the most significant changes has been in education. The first outcomes-based curriculum known as Curriculum 2005 (C2005) was introduced into schools in 1998. Outcomes-based education is intended to allow learners to construct knowledge and develop skills and values in various ways. According to the Department of Education,

> Outcomes-based education, when practised well, allows all learners, irrespective of their background, abilities or personality, the space for:
> - Reasoning and critical thinking
> - Problem solving
> - Retrieval, understanding and use of information
> - Relating learning to existing knowledge and experience
> - Thoughtful reflection on experience. (DoE, 2006, p. 26)

Furthermore "the curriculum seeks to create a lifelong learner who is confident and independent, literate, numerate, multi-skilled, compassionate, with a respect for the environment and the ability to participate in society as a critical and active citizen" (DoE, 2002, p. 3).

Parts of curriculum reform also saw the initiation of a new assessment process. Assessment in grade 9 consists of two components, namely an internal component and an external component. The internal assessment is school based called Continuous Assessment (CASS) and the external component is the Common Tasks for Assessment (CTA). According to the Interim Policy Framework for the Assessment and Support of Learners in Grade 9 (DoE, 2003), the CTA'S are designed, developed and set by the Department of Education and must be administered at least once a year, during the fourth quarter. All learners in grade 9 must undertake the CTA'S.

According to the Assessment Guidelines for Inclusion (DoE, 2000), the CTA should not be seen separate from CASS and should actually build on and reflect the CASS. Various assessment opportunities should exist to accommodate learner diversity. The department of education strongly advocates that educators find multiple ways of exposing learners to learning opportunities that will help them demonstrate their full potential of knowledge, skills, values and attitudes (DoE, 2002). It also states that assessment: should involve learners actively using relevant knowledge in real-life contexts, should not be culturally biased and, should take into consideration learners who are limited in the proficiency of the Language of Teaching and Learning as well as those learners who are physically, emotionally and intellectually challenged.

The importance of the proficiency in the language of teaching and learning is emphasised by the department of education. Nowhere is this more evident as in the case of the Common Tasks for Assessment, which because of its design using 'real-life' contexts, has a heavy reliance on language. Von Glasersfeld (1989) stated, "language users must individually construct the meaning of words, phrases, sentences and texts" (p. 132). Because learners are exposed to the language of mathematics and this mathematics is embedded in a context, I believe that learners' responses to the CTA will be influenced by their own perceptions and outlook.

## 1.2 RATIONALE

My 17 years of experience as a Mathematics educator has taught me that, for many learners whose home language is not English, the words used in Mathematics which appear within contexts pose particular problems. I have also noticed that textbook writers are often mindful with their use of certain words. For instance, this statement appeared in Mathematics textbook, "Discuss what it <u>means</u> to find the average <u>mean"</u> (Pretorius, Potgieter & Ladewig, 2005, p. 48). A further textbook example from Statistics is the use of the term 'class interval' within the tally table. My learners looked at the word 'class' and interpreted the word to mean their class as in class 9F. Some of them enquired if it meant many different classes.

An additional example concerns the phrase 'chirps of a cricket'. I had planned a lesson on direct proportion. The question posed to learners was 'A cricket does 10 chirps in one minute. If the rate of chirps were constant then how many chirps would there be in two minutes?' I expected learners to use this information to draw up a table followed by a linear graph. However I discovered that the only 'cricket' my learners were familiar with was the game of cricket. They were not aware that a cricket is a type of insect that makes a sound, which is referred to as a 'chirp'. As the cricket was something that my learners were not familiar with and could not relate to, the whole exercise of plotting a graph with the number of chirps had to be abandoned.

Over the years such incidents prompted me to start reading about issues around the use of language in mathematics especially when the mathematics is set within a context. I was heartened to find many writers with similar concerns. Schlebusch (2002) conducted a study with Grade 10 learners in an Economics classroom. The focus of the study was Limited English Proficiency (LEP) and the language of learning in an Economics classroom. He argues that in South Africa, an increasing amount of learners are taught through the medium of English and the difficulty arose when he tried to explain economic concepts and terminology in English to learners whose home language was not English. From his study he concluded that the language deficiency of many learners is often hidden in everyday conversation because these learners have sufficient knowledge of pronunciation, basic vocabulary and grammar, which allows learners to participate satisfactorily in undemanding everyday conversations. However a more refined command of language is required in order to achieve academic success.

Academic language proficiency allows learners to grasp concepts, establish relationships between concepts, and analyse, synthesize, classify, store and retrieve information. Boaler (2003) found that there was a total mismatch between the students' achievements in mathematics and their performance in the national testing, which was based on 'real-life' contexts. In addition Boaler (2003) established that the learners experienced problems with the standardised tests because the test questions have three distinguishing characteristics. Firstly, the questions were set in a context that was confusing to linguistic minority and low-income students. Secondly, the solutions to the questions are closed because they do not allow for multidimensional answers. Thirdly, the test uses long and confusing sentences.

Bansilal (2006) in her study on the 2003 CTA's for Mathematical Literacy, Mathematics and Mathematical Sciences identified poor language skills that acted as a barrier to learning. This barrier to learning emerged as a two-fold problem. The learners found it difficult to access the problem because of poor language skills and the problem was that, because of poor language skills, learners were unable to understand the instructions. As Boaler (2003) had identified that the standardised tests had long and confusing sentences, so too did Bansilal with the 2003 CTA. In her study, Bansilal identified a third obstacle to the learners' success in the 2003 CTA. The contextualization of the task contained many explanations and descriptions: "learners when faced with the mass of language sometimes could not distinguish between sentences which were part of the description or part of the instruction" (p.15). It is evident that language does play a significant role in external assessments that are based on 'real-life' context, and to a certain extent, disadvantages learners if they don't have a good command of the language that the assessment task is written in.

According to Cooper and Dunne (2004), "the national testing of children's mathematics mainly via 'realistically' contextualised items might have a variety of unintended consequences, especially for the validity of the assessment of working-class children's knowledge and understanding" (p.69). This is particularly relevant to South Africa. Although there isn't much emphasis on class differences, South Africa does have people from diverse backgrounds and also has 11 official languages. Thus educators are not only faced with learners who speak another language other than English, they are also faced with multicultural classrooms. The CTA is nationally set and is administered to learners who have different cultures as well as different home languages. As Cooper and Dunne caution, such an assessment might have a variety of unintended consequences especially in the validity of the assessment.

According to Boaler (1993), research findings suggest that students perform differently when faced with 'abstract' and 'in context' calculations aimed to offer the same mathematical demand. Boaler found that learners performed poorly in standardised testing which was set within a 'real-life' context. In setting a test within a 'real-life' context, she found that learners who usually performed well in Mathematics performed poorly in tests within context. This suggests that assumptions regarding enhanced understanding and transfer as a result of learning in context may be over- simplistic.

I found that the class in my study, their mathematics results dropped drastically when the CTA marks were considered. The class average for the continuous assessment (CASS) section was 51%. The class average of the CTA marks was 39%. A learner, Thabani, a participant in this study, had an average CASS mark of 93% but his mark for the CTA was 52%. That is a drop of 41%. Another example is Cleo, a second participant in this study, who's average mark was 48% compared to the 28% she obtained in the CTA. The Department of Education (2003) stated, "the Common Tasks for Assessment will also serve as a validation for school-based assessment" (p. 8). However if the CTA results were used as a basis to judge the validity of CASS marks, this would imply that the CASS marks were not good indicators of learners' performance in mathematics. However my impression is that it is actually the other way around.

It was my experiences in the classroom, and encompassing what has been written by Boaler (2003), Cooper and Dunne (2004), Schlebusch (2002) and Bansilal (2006), that prompted me to research whether the CTA for MLMMS, as a national assessment instrument that is language based and set within a context, is a good indicator of my learners knowledge of mathematics. Accordingly, in this study I set out to examine how three participants experienced the CTA. I examined the CTA assessment instrument, observed four CTA lessons, examined the written responses of the learners to the CTA and I also interviewed them.

### 1.3 A PREVIEW OF THE CHAPTERS THAT FOLLOW

In Chapter Two, I summarise the significant literature that was reviewed. In Chapter Three, the methodological approach to this study is discussed. Chapter Four is an analysis of two tasks of the 2005 Common Tasks for Assessment for Mathematical Literacy, Mathematics and Mathematical Sciences. In order to facilitate reading, aspects of the Common Tasks for Assessment have been scanned into Chapter Four. In Chapter Five questions from the CTA, answers to these questions and learner responses were scanned so as to make the study easily readable. Chapter Five encompasses an analysis of data gathered. This formed a basis for answers to my research questions, a discussion on the merits of the study and recommendations, which are discussed in Chapter Six.

# CHAPTER 2

# LITERATURE REVIEW

This chapter has two parts. The first part is organised according to the following sub sections. Subsection one reviews literature on mathematics and real-life context. Subsection two reviews the C2005 Assessment guidelines (2002), the Draft Framework for the Development of CTA's (2002) and a report entitled Enhancing the Quality of Assessment through Common Tasks for Assessment by Poliah (2003) for Umalusi (Council for Quality Assurance in General and Further Education and Training in South Africa).

The second part of the chapter centres on a discussion on the theoretical framework that underpins this study.

## 2.1 LITERATURE ON 'REAL-LIFE' CONTEXT

In keeping with the visions of the Department of Education (DoE, 2002), one of the aims is that Mathematical knowledge, skills and values will enable the learner to apply Mathematics in a variety of contexts.

According to William (1997), contexts used for mathematics teaching are classified into three kinds:

> • Contexts, which bear little or no relation to the mathematics being taught, and which serve primarily to legitimise the subject matter.
> • Contexts having an inherent structure with elements that can be mapped onto the mathematical structures being taught.
> • Contexts in which the primary aim is the resolution of a problem in which no particular mathematics need necessarily be used. (p. 1)

William (1997) draws on the notion of a Macguffin to illustrate the use of contexts in Mathematics. A Macguffin is a metaphor used by Alfred Hitchcock to describe a plot device used to motivate action in a film and to which little attention is paid. William states that relevance of contexts is a Macguffin. Sometimes contexts bear little or no relation to the mathematics being taught but somehow engaging learners in such activities convinces them that they are of relevance to the learners and linked to the real world. According to Cooper and Dunne (2004), 'real-life' contexts are characterised by the extent to which the learners share contexts. The purpose of using 'real-life' contexts in mathematics is to make mathematical tasks more relevant to learners.

At this point the concept of 'real-life' 'esoteric' mathematics test items needs to be clarified. The following examples from Cooper and Dunne (2004), describe a 'real-life' item and an 'esoteric' item.

This is an example of a'real – life' test item.

Find all the possible ways boys and girls can be paired off from the following:

| Boys | Girls |
|---|---|
| David | Ann |
| Rashid | Katy |
| Rob | Gita |

This is an example of an esoteric example.

Find the Cartesian product of the Sets of {a; b; c} and {d; e; f}

Both these examples require the same process yet, by being presented differently, they appear to be different.

A large body of literature has been amassed in recent years, highlighting both the benefits and limitations of using the everyday in mathematics. Moschovich (2002b) states that research has indicated that learners need to be engaged in real- world mathematics and not the type of mathematics that is practiced in isolation of its mathematical applications. Moschovich offers a definition of the words 'real world'. "Real world, when used to describe curriculum, assessments, or mathematical activity, can refer to activities in which students might engage during the course of their present daily lives or to future activities in which students might engage as adults at work" (p. 93). I consider this to be a suitable description for 'real-life' context.

Moschkovich (2002a) proposes that mathematical practices must change so as to close the gap between learning mathematics in and out of school by engaging learners in real-world mathematics rather than mathematics in isolation from its applications. She labels the different mathematical practices, as everyday, academic, professional, workplace and school mathematics. School mathematics refers to the practices of learners and teachers in school, while everyday mathematics refers to the mathematical practices that adults or children engage in. Everyday mathematical practices involve everyday activities such as buying, selling, building, classifying, ordering and so on. Moschovich suggests that learners' activities from outside school must be brought into the classroom. These activities would then parallel 'workplace or non school practices' in that students would use mathematical tools to solve real problems, similar to those that children or adults might face outside school. She states that although schools aim to prepare learners for a combination of everyday, workplace and academic mathematical practices, traditional school mathematics is restricting and provides access to only mathematics experienced in school.

Arcarvi's (2002) view is that everyday mathematics depends on the context and the practice from which mathematics emerges. He proposes that by closely observing learners activities, experiences, interests and daily endeavours, it may be possible to capture everyday situations which can be used 'for establishing bridges to academic mathematics'. He strongly opposes a view held by those who advocate word problems and claim that because of word problems, everyday mathematics and academic mathematics are always integrated. He says that "word problems were merely artificial disguises or excuses for applying a certain mathematical technique" (p. 21).

Arcarvi (2002) suggests that in order to bridge everyday mathematics with academic mathematics, two practices Mathematization and Contextualization need to be considered. Mathematization moves from the everyday to academic, while Contextualization makes sense of a problem that is academically presented and a number of ways that can be used to expand one understands of the mathematics involved. Arcarvi states that these two practices "might be the tool to relate and re-engage us in meaningful contexts, not only for the sake of continuously developing and nurturing our common sense but also as a possible vehicle for enriching academic mathematics itself" p. 23).

Masingila (2002) strongly advocates that learner's in-school practice of learning mathematics can and should be connected to their out of school practice and learning of mathematics. According to Masingila the aim of classroom instruction should be to prepare the learner to deal with real-world and non-real world problems. Educators should help learners acquire the skills that will be useful to solve problems that people encounter in life. However mathematics sometimes can be specific to a particular context. A learner may be able to extract the mathematics required from one context and may not be able to transfer mathematical skills to another context. Masingila suggests that to alleviate this problem, learners need to generalise concepts and procedures. When a learner can generalise concepts and procedures it will be easier to work with a variety of contexts. This has implications for classroom practice. Masingila proposes that educators need to draw from learners out of school mathematics practice because "it provides contexts in which students can make connections and making connections is essential in constructing mathematical knowledge" (p. 31).

Civil (2002) identifies four characteristics of mathematics learning that occur outside school mathematics. Civil considers these four characteristics to be extremely important because she describes them as 'salient' characteristics. She states that learning that takes place in a context out of school occurs mainly by apprenticeship, involves work on contextualised problems, gives control to the person working on the task and lastly, often involves mathematics that is hidden. The value of 'real-life' context as opposed to school mathematics is clear when Civil states that a number of documented studies indicate that people perform 'error-free' mathematics in situations that are valuable to these people while the very same people performed less well in paper and pencil tests that had tasks designed to be similar to their everyday situation. According to Civil the only disadvantage to 'real-life' context is that the mathematics is bound to a particular context and cannot be generalised.

In addition to these authors, Brenner (2002) states that there are many good reasons for including everyday mathematics in the classroom. Bringing in the everyday into the mathematics classroom gives teachers opportunity to experience students' multi faceted approach and multi dimensional answers. Nonetheless she believes that more research is needed on "how the inclusion of everyday mathematics affects student learning and classroom functioning" (p. 63).

Is everyday mathematics really relevant to mathematics education? According to Carraher and Schliemann (2002) the answer to this question is, yes. Nevertheless they go on to point out that it is not directly relevant. Nonetheless, the article further says that mathematics can and must engage students in both realistic and unrealistic situations. Therefore the relevance of everyday mathematics to mathematics education lies in the alternative methods of solving problems which give teachers an opportunity to understand how learners think and to appreciate learners who try very hard to 'bridge the gap' to advance their mathematical knowledge. These writers discuss the advantages of 'real-life' contexts and it is believed that these contexts enhance mathematical learning by linking school mathematics with real world problems. They also further add that mathematics must draw from the 'real' world to enhance mathematical practices and to draw from learners' everyday mathematics. By bridging these two practices, learners will be better prepared to apply mathematical knowledge to the real world and be prepared to continue with mathematics at higher educational institutes.

Moschkovich (2002a) on the other hand, cautions that "these everyday activities can still be described as limited, inflexible, and elementary when compared to the powerful and generalizable methods of academic mathematics" (p. 8). She also suggests that if the everyday is used during classroom instruction and excludes academic mathematics, then this can have huge implications for those learners who want to pursue higher education.

Arcarvi (2002) stated that one of the premises in support of bridging everyday and academic mathematical practices is to build on that which students are familiar with. However he warns by stating that familiarity with a context does not necessarily make life easier. If the context is familiar there is a tendency to believe that an everyday context will give students more leverage in making sense and learning than when confronted with decontextualised abstract mathematical problems. However he says that some everyday mathematical practices "may consist of a mindless application of a routine invented by others and hence may not be very promising in educational terms" (Arcarvi, 2002, p. 27). Choosing a relevant context and expecting genuine mathematics to emerge from the context is not as straightforward as it may seem. Arcarvi says, "it may be that a mathematical and pedagogical eye is required to perceive and use the potential of everyday situations and that some kind of structuring and guidance are needed so as not to leave students at a loss" (p. 27).

Consistent with the theme of context, Boaler (1994) states those contexts are used in the belief that linking school mathematics with real world problems enhances mathematical learning. On the contrary, research findings have indicated that learners are not able to transfer mathematics to either 'abstract' or 'real world' calculations that require some mathematical demand. Boaler (1998) also points out that research suggests that learners do not perceive a link between mathematics learned in school and problems in the 'real world' just because school mathematics examples were presented in context.

Another important point highlighted by Boaler (1994) is that learners are not able to perceive connections between mathematical situations presented in different contexts. Another issue raised by Boaler (1999) was that sometimes 'real-life' contexts are more suited to the adults who teach it than learners themselves. Even though the article focuses on using 'real' contexts in the mathematics classroom and how learners perceive these 'real' contexts, the major problem with 'real' contexts is that learners are required to focus on the mathematics and ignore the context.

Cooper (2001) also questions the role of contexts and states "often children are not expected to treat these problems as real. Instead they either have to ignore real world considerations, or introduce just a very well-judged small dose" (p.256). A suggestion is made that if a 'real' context is to be used then it must only be used if learners have to take into consideration the context of the problem also. Presently learners are given problems with 'real' world context and are forced to ignore the context and focus on the mathematics. Solutions to such problems are often close-ended but the context creates the impression that solutions are open-ended.

Prestage and Perks (2001) state that most of the time, in problems set in context, the context may be 'real' but "it is hardly relevant to anyone other than the question setter" (p. 107). Problems that are set in context usually pose the biggest challenges to educators. It becomes the responsibility of educators to unpack the problem and to help learners answer mathematical questions regardless of the context. For that reason they state that most of the time educators advise learners to ignore the context and look for the school mathematics. Thus what is the purpose of posing problems in context when learners are advised to ignore the context? Another interesting point Prestage and Perks raise is that learners realise that "lots of school mathematics problems are set in ridiculous contexts that are best ignored" (p.107).

Contrary to her view that there are good reasons to bring in the everyday into the mathematics classroom, Brenner (2002) cautions that problems may arise. In her study she used four teachers to carry out a study using a task designed as 'the pizza unit'. Not all the aspects of the 'pizza' problem were realistic or based on everyday life. The conclusions of her findings were that it was not only problematic and challenging trying to incorporate the everyday mathematics into the mathematics curriculum, but the attempt to connect everyday and school mathematics was limited. Murray (2003) reiterates this point by saying that 'so-called' 'real-life' contexts are not necessarily accessible to learners. She further goes on to say that, our 'real life' problems are in any case not really real, but rather 'pseudo-real', since even fairly realistic contexts may create barriers to learners' sense making. To even further emphasise this point, Sullivan, Zevenbergen and Mousley (2003), state that the suitability of contexts is complex and multidimensional. The ways task contexts are presented have potential to alienate some groups of students.

Allen (1988) argues that there is a school of thought which reasons that if school mathematics is applied in a variety of problem solving situations, then two good things will happen, namely, "the student will somehow learn the mathematics needed to solve the problem" and "seeing that mathematics is useful, he will be motivated to learn more mathematics"(p. 2). Allen argues that if this approach to mathematics is useful, it does not imply that it is valuable. By over emphasizing the utility of problem solving, it is done at the expense of "intrinsic values" of school mathematics, which "would serve the student better in the long run" (p. 2). This is a view that Moschovich (2002a) also shares, when she states that if everyday mathematics is the only 'type' used during classroom instruction then this can have huge implications for those learners who want to pursue higher education.

Taylor and Vinjevold (1999) commented that incorporating the everyday in mathematics may derail mathematics goals and should be treated 'judicially'. Subsequently Taylor (2000) stated, "the everyday should not be fore grounded to the extent that it obscures the formal knowledge of schooling" (p.8). Hence Sethole (2004) advocated that mathematics and the everyday are two different discourses and positioning them in an "open relationship" may result in the dominance of one discourse over the other.

The idea that mathematics education can be improved by transporting everyday activities directly into the classroom is simplistic (Boaler, 1993). While it is easy to transport the everyday mathematics into the classroom, it is not as straightforward as it is made out to seem. Cooper and Dunne (2004) caution that test items when placed within realistic contexts might have differential consequences. On the other children with different cultural backgrounds might read the tasks that are embedded in 'practical' or 'real-life' contexts differently. Carraher and Schliemann (2002) say that it is an over simplistic view that everyday activities can easily be transported to the mathematics classroom. Classroom situations are contrived to allow learners to experience everyday activities. However this starts to pose a problem when the everyday activities cannot be varied enough for further mathematical inquiry.

In her article, Boaler (2003) considers the inequities that are created by standardized tests. The article focuses on a low-income school in which the learners made incredible achievements but however were labelled as 'under performing'. The judgement of 'under performance' was based on the results of the standardised tests, which were based on 'real-life' contexts. Boaler argues that the standardized tests and similar tests throughout the United States "stack the decks against language learners, and students from minority ethnic and cultural groups and low-income homes" (p. 502).

Myburgh, Oersen, Poggenpoel and Van Rensburg (2004) comment that due to political changes in South Africa which brought about changes in the country's educational system, it is becoming more evident to find learners from different cultural and language backgrounds in the same classroom. Learners also find themselves in classes where the language of instruction is different from their mother tongue. This situation is similar to the one Boaler (2003) discusses and states that "stacks the decks against language learners". In South Africa, as Myburgh et al. have pointed out, learners are in classrooms where the language of instruction is different from their mother tongue.

Cooper and Dunne (2004) also state that their research was partly motivated by a concern that the

> National testing of children's mathematics mainly via 'realistically' contextualised items might have a variety of unintended consequences, especially for the validity of the assessment of working-class children's knowledge and understanding. Children are often required by

> realistic' test items to make quite subtle judgements about the relevance to their process of solution of their everyday knowledge and experience. (p. 69)

Both Boaler (2003) and Cooper and Dunne (2004) have focused on common testing programmes and from these articles it is clear that some learners are disadvantaged because the testing programme is based on 'real-life' context. Sullivan et al. (2003) argues that before using contexts, its mathematical suitability, interest and relevance to students, potential motivational impact, and the possibility of negative effects or tendency to exclude some students, need to be considered.

The common thread in these studies is the position, which suggests that the boundary between mathematics and the everyday is significant although crossing over cannot be done easily in the learning of mathematics.

## 2.2 A REVIEW OF RELEVANT SOUTH AFRICAN CURRICULUM

The South African education system has a legacy of apartheid education. One of the main reasons for changes in education was to, "move South African schools away from a fragmented, racially defined and ideologically biased curriculum that entrenched inequality', and to 'heal the divisions of the past and establish a society based on democratic values, social justice and fundamental human rights" (DoE, 2003, p. 5).

The C2005 Mathematics policy document states that,

> Mathematical knowledge; skills and values will enable the learner to:
> - Display critical and insightful reasoning and interpretative and communication skills when dealing with mathematical and contextualised problems;
> - Apply Mathematics in a variety of contexts. (DoE, 2002, p. 5)

The Mathematics Teacher's Guide for the Development of Learning Programmes (2003) affirms that

> For the most part Mathematical concepts are abstract. The use of concrete objects and apparatus in the early years – indeed in all years – can contribute to the development of understanding and must therefore be encouraged. The use of contexts for learning activities, which is contexts relevant to the lives of the learners can also contribute to understanding and is similarly encouraged. *However, it is important that the teacher also recognises that learners eventually need to develop understanding in the absence of concrete objects and contexts.* (p. 23) (Italics are mine)

The Department of Education is firm in its view on Mathematics and context. The inference from the above statement about context is that it 'can' contribute to the understanding of Mathematics. But then it eventually states that learners need to develop an understanding of Mathematics in the absence of contexts. What is the role of context in Mathematics? What is relevant context?

The focus of this research is the external component of assessment, which is the nationally set Common task for Assessment (CTA) for Mathematical Literacy, Mathematics and Mathematical Sciences (MLMMS).

Mathematics in the new South African Curriculum, (C2005), is described as

> Mathematics has its own specialised language that uses symbols and notations for describing numerical, geometric and graphical relations. Mathematical ideas and concepts build on one another to create a coherent whole.
>
> While sound mathematical development is very important, this Learning Area Statement recognises that access to Mathematics is a human right in itself, and it is not value or culture-free. In teaching Mathematics, try to incorporate contexts that can build awareness of human rights, and social, economic and environmental issues relevant and appropriate to the learners' realities. (DoE, 2001, p. 16)

The first paragraph defines mathematics while the second paragraph clearly indicates the teaching approach to mathematics. It emphasises an approach to mathematics teaching, which is compatible with a 'realistic' approach.

According to the Assessment Policy (DoE, 1998), 'assessment is the process of identifying, gathering and interpreting information about a learner's achievement, as measured against nationally agreed outcomes for a particular phase of learning' (p. 3). Assessment in grade 9 consists of two components, an internal component and an external component. The internal assessment is called Continuous Assessment (CASS) and each school designs its own internal assessment. The external part of assessment is the Common Tasks for Assessment (CTA).

According to the Curriculum 2005 Assessment guidelines, the internal and external components "need to be structured in such a way that it provides equal opportunities for all learners to give a true reflection of their actual abilities" (DoE, 2002, p. 4). This document advocates that assessment should be based on the following four principles: Design Down, Clarity of Focus, High Expectations and Expanded Opportunities.

> Design Down – this means that the outcomes must be clearly stated at first before developing any teaching and learning activities.
> Clarity of focus – educators must ensure learners are clear about the criteria that will be used for assessment and learners must be sure what they need to demonstrate for that particular assessment.
> High expectations – Emphasis should be placed on learners progressing and experiencing success. (DoE, 2002, p. 5)

The last principle, Expanded Opportunities, is particularly interesting. According to this principle, educators need to find multiple ways in which to expose learners to learning opportunities that will help them demonstrate their full potential in terms of knowledge, skills, values and attitudes. It is specified that,

> Outcomes- Based Assessment (OBA) should
> - Assist learners to reach their full potential
> - Be participative, democratic and transparent
> - Involve learners actively using relevant knowledge in real-life contexts
> - Be integrated throughout the teaching and learning process
> - Be used for remedial as well as enrichment purposes
> - Allow expression or demonstration of knowledge in multiple ways
> - Be linked to individualised, performance –based assessment
> - Offer a variety of vehicles to assess multiple views of intelligence and learning styles
> - Be less likely to be culturally biased relative to learners who are limited in proficiency in the Language of Teaching and Learning (LOLT) or in any other intellectual, physical or emotional capacity. (DoE, 2002, pp. 5-6)

Note that since the CTA is an external part of assessment, it should therefore also follow the principles outlined in the Curriculum 2005 Assessment guidelines (DoE, 2002). From the "expanded opportunities" description, two statements that stand out are, "Involve learners actively using relevant knowledge in real-life contexts' and 'be less likely to be culturally biased relative to learners who are limited in proficiency in the Language of Teaching and Learning (LOLT) or in any other intellectual, physical or emotional capacity". In my view these two statements capture the essence of assessment. I consider the statement where learners should apply relevant knowledge in real-contexts, to be ambiguous in the following ways. What is considered relevant or irrelevant knowledge? And the 'real-life' contexts that are used are they familiar to all learners? The last specification that assessment should not be culturally biased because of learners' limited proficiency in the language of teaching and learning and any other physical, emotional and intellectual disabilities is pertinent. The emphasis here is that assessment should take learners language of teaching and learning into account as well as other disabilities. Since both internal and external assessments should be structured in such a way as to provide equal opportunities for all learners, it follows that the CTA has to be designed so that the language is taken into consideration and it should not be biased against learners "who experience barriers to learning and development" (DoE, 2002, p. 6).

Consistent with the Draft Framework for the Development of CTAs (DoE, 2002), the CTA is an external summative instrument that is used to assess whether grade 9 learners have achieved the specific outcomes of each learning area. The CTA assesses performance-based competencies as well other competencies. It is undertaken in the fourth term according to a national timetable. The CTA must reflect the South African constitution by emphasizing the relationship between Social Justice, Healthy Environment, Human Rights and Inclusivity. Therefore in the design of the CTA, barriers to learning must be taken into consideration.

The document further states,

> The reality of all classrooms is that there is diversity of learning cultures, backgrounds, strengths and weaknesses. Barriers to learning could be situated in the learners themselves, e.g. sensory, physical, intellectual disabilities or disease/illness. They can also be in the learning context, e.g. inflexible curriculum, assessment or lack of resources. Barriers could also arise from the social context, e.g. poverty, violence, difficult home conditions. Assessment tasks must therefore be designed in such a way that diversity of learning styles and learning needs are accommodated. Any barriers to learning and development need to be identified and understood so that learning and assessment can appropriately be adapted or modified to ensure learner success. (DoE, 2002, p. 3)

The implication from the above extract is that the CTA which is nationally set will offer all learners including those with intellectual disabilities, those whose second language is English and those who come from diverse backgrounds equal opportunities which should ensure learner success.

The purpose of the CTA is to be used as an external summative assessment instrument and to provide information on the validity, reliability and the fairness of CASS (DoE, 2002; Poliah, 2003). Considering that the CTA is an external assessment tool, such claims about its validity functions are hard to justify but how is it able to measure the validity of CASS, which is school based? The implication here is that the learners CASS should be consistent with the mark obtained in the CTA. An inconsistency between CASS and CTA results would imply that school based assessment is of a higher or lower level than that of the CTA.

Furthermore the implication is that the CTA is that instrument that can verify whether schools are really testing the competencies they are claiming to. For example an under resourced school with learners from low income groups whose home language is not English, will design and carry out assessments according to the context which is meaningful to their learners. In comparison, a well-resourced school in an affluent area, which may use a screening process for admission, will carry out CASS pertaining to their circumstances. How is it possible to design an instrument that can accommodate the needs of multicultural and diverse learners as well as those learners whose home language is not English while simultaneously fulfilling the function of validation of CASS?

However, my study will reveal that some of these all-encompassing claims are not warranted with respect to the 2005 CTA. From the Framework document it is clear that the CTA is based on a real-life context. The Plan for the development of the CTA indicates that the next step is to choose a 'context' (DoE, 2002, p. 5). Furthermore it states, "Performance-based assessment permits learners to show what they can do in a real life situation. Performance based assessment provides a systemic way of evaluating those reasoning skills and outcomes, e.g. practical problem solving skills for MLMMS" (ibid, p. 10). These excerpts convey the importance attached to the particular context chosen for assessment.

The Interim Policy Framework for Assessment and Promotion of Learners in Grade 9 states that the Department of Education will fulfil a co-ordinating, supportive and monitoring role (DoE, 2003). In addition to that, "the teachers should mark the Common Tasks for Assessment using the marking guide or memoranda supplied by the Department of Education and officials of the provincial education department must monitor and moderate marking" (DoE, 2003, p. 7). It will be revealed later in my study that although teachers marked the Common Tasks for Assessment it was neither monitored nor moderated.

Poliah (2003) under the auspices of Umalusi (Council for Quality Assurance in General and Further Education and Training) released a report, "Enhancing the Quality of Assessment through Common Tasks for Assessment" on the Common Tasks for Assessment (CTA). The paper traces the philosophy underpinning the use of the CTA's, its development and implementation. Poliah reported that teams of learning area experts drawn from provincial education departments developed the CTA's. The designing of the tasks was co-ordinated by the GETC Curriculum Directorate of the Department of education and supported by the Independent Examinations Board (IEB). One of the functions of the CTA is to strengthen the capacity for school based continuous assessment and is also designed as a developmental instrument to ensure that school based assessment is testing competencies and achievements.

According to Poliah (2003) the design of the CTAs adhered to the following principles:

- A task could assess a variety of specific outcomes
- The tasks should be grounded in real-life context
- The main question to be answered could be formulated as a problem
- Explicitly stated scoring criteria should be included as a part of the task
- The instructions should be clear
- The task should be challenging and stimulating to the learner
- The tasks should be structured so that you can help students succeed. (pp. 6-7)

I believe the last design feature contradicts the purpose of the CTA. I assume the 'you' in the statement refers to the educator. One of the main purposes of the CTA as stated by Poliah 'is to provide information on the validity, the reliability, and fairness of continuous assessment (CASS)'. On the one hand the CTA is used to validate CASS and on the other, the tasks must be designed with the intention that the educator can intervene and assist learners to succeed. How the CTA would be considered as valid if it allows educators to intervene? Any intervention in an assessment task would surely change the demand of the 'assessment task'.

As a Council for Quality Assurance in General and Further Education and Training, Umalusi was responsible for the moderation of the CTAs. The purpose for moderation was to approve the CTA with regards to quality, standard and suitability of the CTA. Moderation also provides constructive feedback to the Department of Education and recommendations for the future developments of CTAs.

The following criteria were concentrated on during the moderation process:

- Content: accuracy, relevant appropriate and interesting?
- Standard: appropriate for Grade 9 learner?
- Use of language: easily accessible and free of bias?

- Variety as regards forms of assessment?
- Appropriateness of forms of assessment to the task/activity?
- Diagrams, pictures, graphics, etc, clearly marked and easily readable? (Poliah, 2003, p. 7)

The moderation criteria are particularly significant to this study. This report by Poliah on the moderation criteria of the CTA was released in 2003 and is therefore a suitable framework to use in order to analyse the 2005 CTA.

Poliah (2003) brings up the Common Assessment Tasks (CAT's) written by learners in the State of Victoria in Australia. While he avoids making inferences to the South African Common Tasks for Assessment (CTA's), one cannot escape the similarities between the names of these two types of assessments. Secondly, both the CAT and the CTA are external assessments. Thirdly, one of the functions of CAT was to validate the school-based assessment. The similarities between the names and functions convey the impression that the CTA is a replication of the Common Assessment Tasks of the State of Victoria?

I would like to conclude this section by raising four concerns of mine, arising from an analysis of the 2005 CTA. The Common Tasks for Assessment (CTA) for Mathematical Literacy, Mathematics and Mathematical Sciences (MLMMS) for 2005 comprised one paper to be undertaken for five hours. It was left to the discretion of the school how to administer the CTA. The 2005 CTA was a five-hour exercise with a mark allocation of 100 marks. The focus of the CTA was the Kruger National Park. It comprised four tasks with 13 activities and 39 sub questions.

Firstly the CTA is based on the assumption that all learners engaging in the CTA are familiar with the Kruger National Park. Secondly, the assumption is also that all learners are proficient in English and proficient in the language. Thirdly, there is the assumption that learners are familiar with the notions of National Parks, touring, upgrading of accommodation and animal management and control. Words such as 'base occupancy', 'moratorium', 'sustainable', 'census', just to mention a few, are assumed to be part of learners' vocabulary. Fourthly the questions in the CTA are not open-ended questions. If learners focus on the context instead of the mathematics, then learners' responses are going to be considered 'wrong'.

When one considers all the articles pertaining to school mathematics and everyday mathematics, I have realized that the CTA has huge cultural, sociological and political implications. My classroom is a multicultural classroom. Learners experience problems with language. Most public schools have learners whose mother tongue is a language other than English. South African schools have to contend with race, culture, class etc. Therefore I think there is not enough research on how South African learners experience the mathematics CTA. How relevant are the tasks to their everyday experiences? This therefore prompts me to pose some questions. What do we mean by everyday or real life mathematical activities? Are learners expected to find these activities relevant? Do the CTA's advantage or disadvantage learners?

## 2.3 THEORETICAL FRAMEWORK

The first outcomes-based curriculum introduced in democratic South Africa was known as Curriculum 2005 (C2005) and was introduced into schools in 1998. (DoE, 2006, p. 12). The curriculum introduced new perspectives and challenges for the teaching and learning of mathematics. Amongst the various challenges, there is also a shift to a problem centred or constructivist approach to the teaching and learning of mathematics as implied in the new curriculum documents.

Moll (2002) stated that the underlying theory of the C2005 is constructivism. He commented that the document *Curriculum 2005: Towards a Theoretical Framework* (DoE, 2000) looked explicitly towards constructivism to provide the teaching and learning solutions called for by OBE (Outcomes-Based Education) in South African schools. He contends that the Department takes a position and holds 'constructivism' to be the basis of the new teaching approach called for by OBE (p. 6).

What is Constructivism? According to Epstein (2002), constructivism, a theory of learning, emphasizes the importance of the knowledge, beliefs, and skills an individual brings to the experience of learning. It recognizes the construction of new understanding as a combination of prior learning, new information, and readiness to learn.

Epstein (2002) offers a deeper insight into constructivism by identifying nine general principles of learning that are derived from constructivism. Of these nine principles, four are directly related to this study:

- Learning involves language: the language that we use influences our learning.
- Learning is a social activity: our learning is intimately associated with our connection with other human beings, our teacher, our peers, our family, as well as casual acquaintances.
- Learning is contextual: we learn in relationship to what else we know, what we believe, our prejudices and our fears.
- One needs knowledge to learn: it is not possible to absorb new knowledge without having some structure developed from previous knowledge to build on. (p. 3)

I will briefly discuss how these four principles relate to this study. The focus of this study is on the CTA's in MLMMS, which are based on 'real- life' contexts. The language used in the CTA influences how learners respond to the CTA. The 'language' in this case is not only the written language of the CTA; the dialect of learners will also influence how they respond to the CTA. Secondly, over the years, learners have related to a number of individuals including parents, teachers, community and peers. These relations would have influenced the knowledge learners have developed. Thirdly, learning is contextual. The 'context' here has various interpretations.

The word 'context' is not as simplistic as it is assumed to be. Context on the one hand, could refer to contexts that learners are familiar with. Familiar contexts also create belief systems, prejudices and fears. Contexts such as HIV/Aids may be a sensitive context while contexts such as the seaside or Robben Island, may be unfamiliar. Contexts could also refer to the situation in which a problem is embedded. The context of the classroom also influences learning. As a result the learners are influenced by a number of factors when relating to context as a situation with a problem embedded in it or to the context of the classroom or examination. Lastly learners will respond to the CTA's on the basis of what they already know. When these learners attempt the CTA in the fourth term, they have already successfully completed 8 years of schooling and three terms of grade nine.

During my study, I could not escape the fact that language was an issue since the MLMMS CTA is language based. I was forced to search for literature that would help me understand the situation better. I found Au's (1998) study helpful and enlightening. Au uses social constructivism to address the literacy achievement gap of students of diverse backgrounds.

Au describes learners of diverse backgrounds as learners who are from low-income families; African American, Asian American, Latina/o, or Native American ancestry; and speakers of a home language other than the standard American English. In her study, to develop the argument for a diverse constructivist perspective, Au discusses social constructivism and its application to school literacy learning.

Au (1998) identified 5 explanations for the literacy achievement gap.

The 5 explanations are:

*Linguistic differences*: linguistic differences stem from the fact that many students of diverse backgrounds speak a home language other than Standard English.

*Cultural differences*: students have difficulty learning in school because school instruction does not follow their community's cultural values and standards for behaviour.

*Discrimination*: the system of schooling is structured, so as to prevent equality of education and outcome.

*Inferior education*: students of diverse backgrounds are exposed to deteriorating buildings, outdated textbooks, and inexperienced teachers. Material circumstances in these schools led to inequalities in education.

*Rationales for schooling*: high school fees, schools' constitutions/rationale favour mainstream learners instead of learners from diverse backgrounds. In this case, mainstream learners refer to those whose home and school language is English.

Although Au's (1998) explanations relate to her study on literacy achievement, it is applicable to any study across the curriculum. It is particularly relevant to this study because the school that was used has learners from low-income families. The school fee of R750 per year, is an indication of which income group the school services. It is also particularly relevant to this study, which focussed on the CTA, which involved extensive use of language.

While Mathematics has its own 'language' and terminology, nevertheless learners in my study were taught through the medium of English. As a result language plays a significant role in how learners interpret and make meaning. Vygotsky (1934) stated, "it is not merely the content of a word that changes, but the way in which reality is generalized and reflected in a word" (p. 213). This is very significant with the CTA. The CTA for MLMMS has mathematical tasks embedded in a context.

Zevenbergen (2001), states that "providing a context for a problem means it has to be embedded in words" (p. 46). This brings me back to the statement by Vygotsky, which says, "reality is generalized and reflected in words". The CTA is embedded in words and reality is generalized in these words. By embedding the tasks within a context is generalizing reality and assuming that the reality is familiar to all learners.

With reference to the 2005 CTA, the theme is the Kruger National Park. The reality of Kruger National Park is generalized and assumed to be familiar to all learners. However it is compulsory for all grade 9 learners to undertake the CTAs. Consequently learners from diverse backgrounds as well as learners whose home language is not English are compelled to write the CTA. Learners who lack proficiency in English are suddenly faced with tasks for mathematics centred on language because the reality of the Kruger National Park is generalized and reflected in language in the form of mathematical tasks embedded in words.

Vygotsky (1934) complements his earlier statement by stating that words lead to thought processes.

> The relation of thought to word is not a thing but a process; the relation of thought to word undergoes changes that themselves may be regarded as development in the functional sense. Thought is not merely expressed in words; it comes into existence through them. Every thought tends to connect something with something else, to establish a relation between things. Every thought moves, grows and develops, fulfils a function, solves a problem. (p. 218)

This is relevant to this study because the CTA had many tasks that involved a large number of words. With learners whose home language is not English, each word forces the learners to connect the words to something they already know so as to 'make sense' of the words. Each word in English has to be understood before applying the mathematics in the particular context. Zevenbergen (2001) substantiates this point by stating that there are specific examples of language that can cause a barrier to the access learners have to learning mathematics. Walkerdine (as cited in Zevenbergen, 2001) emphasizes the point of language being a barrier. The study showed that two words namely, 'more' and 'less' are used differently according to social background. The study also documented that working-class families are less likely to use the word 'less' than middle class families. This study suggests that "many of the working- class students may not have the language, and hence concepts, to comprehend clearly and unambiguously what is meant" (p. 43).

The role of how learners experience mathematical tasks based on real-context is also a central focus of this study. In some cases the real-context has no relevance to mathematics and learners have to ignore the context and focus on the mathematics. Mathematical tasks presented in real-context have the potential to produce a variety of responses as well as multifaceted solutions for some learners.

This study embraces the basic view of constructivism. Central to this broader study is that constructivism is used in a descriptive position. Built on this descriptive position is the firm belief in the use of both language and real-contexts as important mediators in the process of knowledge construction.

## 2.4 CHAPTER SUMMARY

In this chapter, the literature review focused on real-life context in mathematics and Department of Education curriculum documents. The theoretical framework that underpins this study was presented.

# CHAPTER 3

# RESEARCH METHODOLOGY AND DESIGN OF STUDY

This chapter will present the research methodology and the design of the study. Secondly, the qualitative approach that was adopted for this research project, together with the critical questions upon which this research was based, is discussed. Thirdly, this chapter examines the context of the study and provides an explanation of the process of the selection of the participants. Finally, the design of the study and the data collection instruments, which were used to investigate how learners experienced the Common Tasks for Assessment in Mathematical Literacy, Mathematics and Mathematical Sciences, is discussed.

## 3.1 PURPOSE OF THE RESEARCH

The aim of this study was to understand how learners experience the Common Tasks for Assessment (CTA) in Mathematical Literacy, Mathematics and Mathematical Sciences (MLMMS), which are based on 'real-life' context. The related critical research questions are:

Research Question 1:

How did the teacher mediate the Common Tasks for Assessment in Mathematical Literacy, Mathematics and Mathematical Sciences?

Research Question 2:

What are the learners' perceptions of the Common Tasks for Assessment in Mathematical Literacy, Mathematics and Mathematical Sciences?

Research Question 3:

What are learners' experiences of the Common Tasks for Assessment in Mathematical Literacy, Mathematics and Mathematical Sciences as revealed by the actual responses to certain tasks?

## 3.2 RESEARCH APPROACH

Qualitative research is a broad term for exploratory methodologies described as ethnographic, naturalistic, anthropological, field, or participant observer research. According to Cohen, Manion & Morrison (2000) "the interpretive paradigm is characterised by a concern for the individual, to understand the subjective world of human experience, to retain the integrity of the phenomena being investigated, efforts are made to get inside the person and to understand from within" (p. 22).

Merriam (2000), states, "learning how individuals experience and interact with their social world, the meaning it has for them, is considered an interpretive qualitative approach" (p. 4), which is the main aim in this study. The emphasis here is that an individual socially constructs meaning as they interact with the world. Reality is not permanent because there are various constructions and interpretations of reality. The interpretive paradigm also emphasises the importance of looking at people in their natural settings, which is a characteristic of this study. The learners' experience of the Common Tasks for Assessment (CTA's) is a way of understanding how individuals experience the CTA's since there are various constructions and interpretations of reality.

The following characteristics of qualitative research particularly in the interpretive paradigm provided by Key (1997) are, "purpose, reality, viewpoint, values, focus, orientation, data, instrumentation, conditions and results" (p. 2).

Keys' (1997) characteristics are a useful tool that emphasises this study which is located in the interpretive paradigm:

> *Purpose:* I am seeking to understand learner's interpretations of the CTA's.
> *Reality:* my reality changes as I explore my learner's perceptions of the CTA's.
> *Viewpoint:* reality is what each learner perceives it to be.
> *Values:* as the researcher of this study, values will have an impact and must be understood and taken into account when conducting and reporting this research.
> *Focus:* the focus of this study is holistic a complete picture is sought.
> *Orientation:* in this study theories evolve from data as it is collected.
> *Data:* the data collected can be subjective because the data in this study are perceptions of the learners in the environment.
> *Instrumentation:* in this study the researcher is the primary collection instrument.
> *Conditions:* the investigations in this study are conducted under natural conditions.
> *Results:* the results are valid in this study because the focus is to gain 'real', 'rich', and 'deep' data. (Key, 1997, p. 2)

Neuman (1997) states that an interpretive researcher aspires to develop an understanding of social life and how people construct meaning in natural settings. He emphasises the importance of natural settings as opposed to contrived settings. Lincoln and Guba (1985) also suggest that research should be conducted in natural, uncontrived and real world settings. Lincoln and Guba (1985) further identify the characteristics that make humans the best instruments for naturalistic inquiry. They say that humans are receptive to environmental cues, they are also able to interact with the situation, they have the ability to amass information at different levels simultaneously, they are able to perceive situations holistically, they in addition can process data as soon as it is available, they can also provide feedback, verify data and humans can explore unexpected responses.

As a researcher I view my study as a naturalistic inquiry since the natural setting is my school and the participants are learners from my school. Merriam (2000), Eisner (1991), Cohen et al (2000) and Lincoln and Guba (1985) emphasise that the researcher is the primary instrument for data collection and data analysis. As the researcher in this study I am the primary instrument for data collection and analysis and my learners are used as data sources.

Cohen et al (2000) indicate that the interpretive paradigm is "most naturally suited to case study research" (p. 181). Yin (1984) on the other hand defines the case study research method as "an empirical enquiry that investigates a contemporary phenomenon within its real-context and in which multiple sources of evidence are used" (p. 23). Tellis (1997) as well states that case studies are designed to bring out the details from the viewpoint of the participants by using multiple sources of data. This study is in the interpretive paradigm and it is investigating 3 learners' 'experience of the Common Tasks for Assessment in a real-context that is in my own school in the learners' own classrooms. In addition, this study used multiple sources of evidence such as learners' responses to the CTA, classroom observation, interviewing and document analysis.

Soy (1997) states that case study research stands out at conveying an understanding of a complex issue or object and can extend experience or add strength to what is already known through previous research. Soy further suggests that case studies emphasize detailed contextual analysis of a limited number of events or conditions and their relationships. In this study the research aims to provide an understanding of the CTA and how learners' from one school respond to the CTA's. The study also aims to provide a detailed contextual analysis since the school is unique and according to Cohen et al " contexts are unique and dynamic, hence case studies investigate and report the complex dynamic and unfolding of events, human relationships and other factors in a unique instance"(p.181).

Hitchcock and Hughes (1995) further suggest that using the case study approach is notably valuable when the researcher has little control over events. As stated by Hitchcock and Hughes the case study has numerous features:

- It is concerned with a rich and vivid description of events relevant to the case.
- It blends a description of events with the analysis of them.
- It focuses on individual actors or groups of actors, and seeks to understand their perceptions of events.
- It highlights specific events that are relevant to the case.
- The researcher is integrally involved in the case.
- An attempt is made to portray the richness of the case in writing up a report. (p. 317)

Merriam (1988) provides the following table that typify case study research.

Table 3.1 Characteristics of case study research in Qualitative research

| Point of Comparisons | Qualitative Research |
|---|---|
| Focus of research | Quality (nature, essence) |
| Philosophical roots | Phenomenology, symbolic interaction |
| Associated phrases | Fieldwork, ethnographic, naturalistic, grounded, subjective |
| Goal of investigation | Understanding, description, discovery, hypothesis testing |
| Design characteristics | Flexible, evolving, emergent |
| Setting | Natural, familiar |
| Sample | Small, non-random, theoretical |
| Data collection | Researcher as primary instrument, interviews, observations |
| Mode of analysis | Inductive (by researcher) |
| Findings | Comprehensive, holistic, expansive |

(Merriam, 1988, p. 18)

The features of case studies are encompassed in this research and supported by Cohen et al's (2000) assertion that a case study allows events and situations to speak for themselves.

### 3.3 CONTEXT OF THE STUDY

This study was conducted at a secondary school in Kwa-Zulu Natal (previously an all Indian school). This is a co-educational school with an enrolment of 2000 learners. Approximately 85% of the learners are African, with the remaining 15% of the total learner population being made up of 2 White learners, 30 Coloured learners and the remaining learners being Indian. The majority of the learners reside in Clairwood, Umlazi, and Illovo. Learners from Umlazi use the trains, busses or taxis to travel to school, while learners from Illovo travel in special buses that transport learners to school and park on the premises until the end of the school day to transport them back. The school day, timetable, activities as well as examinations are conducted in relation to the Illovo learners. The remaining learners are within walking distance of the school.

There are between 40 - 45 learners per class in grades 08 and 09, while in grades 10, 11 and 12 there are between 35 - 40 learners per class. On the whole there are approximately 50 class units. The school has old buildings, which are in total disrepair. The classrooms have broken windows; no doors in most classrooms and metal gates serve as classroom doors. There is not enough furniture to accommodate a full class of 45 learners. The school fees per year are R750. Since learners come from low-income families, it is almost impossible in most cases to acquire the full school fees. The school works closely with a cluster of schools from the area. All control tests and examinations are set by the cluster of schools so as to standardise testing.

In view of the fact that I am an educator at this school, I chose the school and participants through convenience sampling. Convenience sampling is a method of non-probability sampling, which is appropriate to qualitative research. Neuman (1997) affirms that convenience sampling "select anyone who is convenient" (p. 205). With reference to convenience sampling, Cohen et al (2000) state that it is occasionally called opportunity sampling. The reason for this is that the situation provides the opportunity. Thus convenience sampling "involves choosing the nearest individuals to serve as respondents and continuing that process until the required sample size has been obtained" (p. 102).

In this study the school that I teach in was chosen. Secondly one class was chosen to participate in the study. Since the CTA is a nationally set external assessment all grade 9 learners are required to complete the CTA. The focus of this study is the CTA for MLMMS. The roll of the class chosen for the study was 41. All the learners in this class were African. The entire class attempted the CTA's in MLMMS. I thereafter requested volunteers to participate in case studies. Three learners volunteered as case study participants.

Given that the CTA was administered in the fourth term, and immediately after that learners sat for their final examinations, I was able to set up a timetable to interview these three learners. I had to interview these learners during school hours because two of the learners had transport problems. Moreover Cohen et al (2000) also state that to a certain extent, students frequently serve as respondents based on convenience sampling. Consequently the researcher chooses the sample from those to whom one has easy access.

## 3.4 ETHICAL ISSUES OF THE STUDY

Merriam (2000) states, "a 'good' qualitative study is one that has been conducted in an ethical manner" (p. 29). Bell (1991) suggests that once a research project has been decided upon, official channels should be formally approached for permission. Initially a formal request was made to the university requesting permission to carry out this study. On receiving ethical clearance from the university, the next step was to make a formal request to the Department of Education. In keeping with Cohen et al. (2000), formal requests were also made to the school principal, chairperson of the governing body, the mathematics head of department, the participants in the study, their parents, as well as the teacher.

Cohen et al. (2000) propose a two-stage process for informed consent in relation to young children. Stage one is to obtain consent from adults responsible for the prospective participants and stage two is to obtain consent from participants themselves. In my study I chose to obtain consent from the participants first and then obtained consent from adults responsible for the participants. I requested for a meeting with the class concerned. I met the class during one of their mathematics lessons. The participants in this study were promised confidentiality and anonymity. I explained to the participants what I meant by 'confidentiality' and 'anonymity'. I also received informed consent from the teacher to videotape her mediating the CTA. I explained to the teacher that the lessons would be transcribed. When the transcription was completed I offered the teacher the opportunity to verify the correctness of the transcription.

Consistent with Bell's (1991) view, the participants were informed on what would be done with the information they provided and how it would be used to enhance this study. Participants were eager to be part of the study. Once a relationship was forged with the participants I immediately obtained informed consent from parents and guardians. The letter to parents and guardians outlined the study, the purpose of the study, provided details on the data collection process and provided for informed consent from the parent or guardian.

On securing the necessary consents, a second meeting was held with participants. In this meeting I reiterated the points of confidentiality and anonymity and all participants were informed that since their participation in the study was voluntary they might withdraw at any time from the study. At all times I was aware of Merriam's (2000) statement, "to a large extent, the validity and reliability of a study depend on the ethics of the researcher. It is ultimately up to the individual researcher to proceed in as ethically a manner as possible" (p. 29).

I followed the university's prescribed procedure for obtaining ethical clearance and was granted the ethical clearance number HSS/06194.

## 3.5 DESIGN OF THE STUDY

The design of the study involved six phases as indicated in the table below (table 3.2). The following table provides a description of the tasks that I had attempted together with the activity that occurred from each of the tasks.

Table 3.2 Six phases of the design of the study

| Phase | Task/Activity | Time Frame |
|---|---|---|
| 1 | Planning video recording<br>Learners engage with CTA's for 5 hours over 5 days. Video recording for 5 days. | 5 days<br>5 hours |
| 2 | Video recording<br>Viewing of CTA activities for 4 days | 1 hour per day over 20 days |
| 3 | Learners responses to CTA in MLMMS<br>Reading and interpreting learners solutions to tasks in the CTA | 30 days<br>60 hours |
| 4 | Planning interviews<br>Drawing up a timetable for the three voluntary participants through convenient sampling and informing participants of the time and venue of interviews | 1 day<br>2 hours |
| 5 | Setting up and conducting unstructured interviews<br>Transcription of interviews from audio recordings | 10 days<br>15 hours |
| 6 | Department of Education 2005 CTA<br>Document analysis of Department of Education 2005 CTA. | 10 days<br>20 hours |

As the researcher, initially for phase one I had to find out from the principal the anticipated date of delivery of the CTAs as well as the dates for commencement of the CTAs. Since the school is old, I had to check if the plug points in the teacher's classroom were in working order. The plug points were completely removed or damaged. I had to make arrangements for the teacher to be moved to another classroom with working plug points. The reason for this was that the class could be video taped while engaging in the CTAs. I also needed the teacher's timetable to establish at what times the class was involved with mathematics and I needed to know exactly on which day the CTA would commence in order to make an appointment with the person who would video record the 5 lessons for 5 hours over 5 days.

Phase two involved viewing the video recordings and phase three was reading through learners' responses to the CTAs particularly the three voluntary participants CTAs. I read through their responses and planned phases four and five, which were the unstructured interviews. Phase six involved a document analysis of the 2005 CTA.

## 3.6 DATA COLLECTION METHODS AND INSTRUMENTS

In this study document analysis, interviewing and observation were used as data collection methods. The 2005 Common Tasks for Assessment and learner written responses to the Common Tasks for Assessment were the data collection instruments for document analysis. Interviews with learners were the instrument for interviewing. The instrument used for observation was video recording. The document analysis of the 2005 CTA, learners' responses to the CTAs, interviewing the three voluntary participants and observation of the CTA activities permitted me to interpret how learners responded to the Common Tasks for Assessment in Mathematics, Mathematical Literacy and Mathematical Sciences.

### 3.6.1 Document analysis

Hoepfl (1997) states that a source of information that can be invaluable to qualitative researchers is the analysis of documents. Cohen et al (2000) convey that content analysis could be used in the analysis of educational documents. While content analysis can clarify the content of the document, it can also throw "additional light on the source of communication, its author, and on its intended recipients, those to whom the message is directed" (Cohen et al, 2000, p. 165). Mayring (2000) states that in qualitative research certain procedures such as step by step analysis or coding into categories is not possible if the research question is highly open-ended and explorative and if a more holistic analysis is planned. Kohlbacher (2006) emphasises a vital point by stating that not all units of analysis must be coded, however assigning categories to text portions is crucial for qualitative content analysis.

Neuman (1997) states that content analysis is "nonreactive" for the reason that "the process of placing words, messages, or symbols in a text to communicate to a reader or receiver occurs without influence from the researcher who analyses its content" (p. 273). The implication here is that content analysis lets the researcher divulge the content from a particular document. With content analysis the analysis of learners' written responses to the CTA can "compare content across many texts" (Neuman, 1997, p. 273). Thus the analysis of the CTA can be compared to the analysis of learner's written responses to understand how learners experience the Common Tasks for Assessment. Neuman summarises by stating that a researcher conducts "a reading" to determine meaning entrenched within the text. Every reader brings his or her subjective understanding to a text. Neuman further states that "true meaning is rarely simple or obvious on the surface; one reaches it only through a detailed study of the text, contemplating its many messages and seeking the connections among its parts" (p. 68).

The Common Task for Assessment (CTA) in Mathematical Literacy, Mathematics and Mathematical Sciences is set by the Department of Education. The CTA is an educational document and content analysis can be used to determine how learners (the intended recipients) experienced the CTA. The intention in this study is to analyse the content of the CTA and to reveal its messages, meanings and symbols.

The following criteria were used by Umalusi (Poliah, 2003) for the moderation of the CTA.

- Content: accuracy, relevant appropriate and interesting?
- Standard: appropriate for Grade 9 learner?
- Use of language: easily accessible and free of bias?
- Appropriateness of forms of assessment to the task/activity?
- Diagrams, pictures, graphics, etc, clearly marked and easily readable? (p. 7)

In this study the same moderating criteria were used to overview the CTA in MLMMS. Each criterion was used to discuss the CTA. For example, under the criteria of language, a discussion centred on the use of language in the CTA. Another example is the criteria that focused on diagrams and pictures. Under these criteria, the use of visual contents was discussed.

### 3.6.2 Interviews

According to Cohen et al (2000), the research interview has been defined as "a two-person conversation initiated by the interviewer for the specific purpose of obtaining research relevant information" (p. 269). Further, Cohen et al state that interviews enable participants to discuss their interpretations of the world in which they live and it also gives them an opportunity to express how they observe situations from their own point of view. An "interview is not simply concerned with collecting data about life: it is part of life itself, its human embeddedness is inescapable" (Cohen et al, 2000, p. 267).

Hoepfl (1997) states that interviews can be used in conjunction with observation, document analysis or other techniques for data collection and also comments that interviews utilise open-ended questions that allow for individual variations. The interview process is a human activity unlike the document analysis. Interacting with participants during the interview process has made me aware of how they viewed the Common Tasks for Assessment. Participants provided written responses to the CTA because it is a requirement. However when the same participants were interviewed about the CTA, their personal points of views emerged with regards to the CTA, which could not be 'seen' through their written responses. This point is emphasised by Cohen et al (2000) when they state "one advantage of interviews is that it allows for greater depth than is the case with other methods of data collection" (p. 269).

In this study the type of interview used was the unstructured interview. Lincoln and Guba (1985) suggest that the unstructured interview is useful when the researcher is "not aware of what she does not know, and therefore, relies on the respondents to tell her" (p. 269). According to Boeree (1998), an unstructured interview means, "although you may interact with the person, ask questions, ask for details, for clarification, however you should avoid forcing the person in any direction, other than keeping their attention on the original topic" (p. 1).

In this study the researcher raised an issue namely the CTA in conversational style and allowed participants to express their views. By allowing the participants to talk about what was important to them pertaining to the CTA, provided insight to the interviewer about what was important and relevant to the participants. The questions for the interview emerged from the context itself. There was no predetermination of questions or wording. This was also in line with the view of Cohen et al (2000) recapitulation that "the more one wishes to acquire, non-standardised, personalized information about how individuals view the world, the more one veers towards qualitative, open-ended, unstructured interviewing" (p. 270). Cohen et al sum up by saying that the unstructured interview is an open situation allowing for greater flexibility and freedom.

The recording of data in the interview process is very important. One has to decide whether to rely on written notes or a tape recorder/video recorder. According to Hoepfl (1997) written or tape recorded interviews is a matter of personal preference. However Patton (1990) says that a tape recorder in an interview is 'indispensable' (p. 348).

Atkinson and Delamont (2006) stated that in qualitative research, the interview is usually tape-recorded and transcribed whenever possible. They provide the following reasons as to why interviews should be recorded and transcribed.

- It helps to correct the natural limitations of our memories.
- It allows more thorough examination of what people say.
- It permits repeated examinations of the interviewees' answers.
- It opens up the data to public scrutiny by other researchers who can evaluate the analysis that is carried out.
- It therefore helps to counter accusations that an analysis might have been influenced by a researcher's values or biases.
- It allows the data to be reused in other ways from those intended by the original researcher.

(Atkinson & Delamont, 2006, p. 321)

Key (1997) suggests that the researcher should choose an interview environment which makes the participants comfortable, secure and at ease to speak openly about their point of view. Cohen, Manion and Morrison (2000) also emphasise this point by stating that the interviewer has to establish an appropriate atmosphere so that the participant feels secure and speak more freely.

In this study the association between the interviewer and interviewees has always been one of trust. To the participants in the study, the researcher had been both their form educator and mathematics educator in grade 08. Unfortunately the following year they were moved to a new mathematics educator and new form educator. This was very disappointing for the learners. Because of my relationship with the learners from this class they were eager to be part of the study.

I had drawn up a timetable for the days and times of the interviews. The three participants were duly advised on the time, date and venue of the interviews. The day before each interview, I would approach the participants to remind them about the interview.

The first interview took place in the school boardroom. Because the venue does not have any working plug points, I was prepared and carried a set of batteries together with a tape recorder. As stated earlier, I have a cordial relationship with the participants so the first participant was eager to be interviewed. In an earlier meeting the participants were made aware that interviews would be tape-recorded. Letters of consent to parents also provided this information.

The tone of the interview was informal in a more conversational style. I explained to the participant that this was a follow up to the CTA in MLMMS. In an informal conversational manner I began speaking about the CTA and then let the participant pursue the conversation. Since the interview was unstructured, there were no set questions. The questions developed in the course of the interview. If the participant made a claim then I would probe him to substantiate. There was no time limit to the interview; however the first interview lasted for approximately an hour. The same procedure followed with the second and third interviews.

### 3.6.3 Observation

Cohen, Manion and Morrison (2000) suggest that the appeal of observational data lies in the fact that it offers the researcher an opportunity to gather live data from live situations and it is also less predictable. According to Morrison (1993), observation permits the researcher to gather data in the physical setting (in this study the physical setting is the classroom), in the human setting (the participants in the study), the interactional setting (the interactions that take place in the classroom) and the programme setting (the resources that are available in this classroom, and the teachers teaching style).

According to Hoepfl (1997) the conventional form of data collection in naturalistic research is in the "observation of participants in the context of a natural setting" (p. 7). Hoepfl maintains that observation can lead to deeper understandings than interviews alone, because it provides knowledge of the context in which the events occur as well as it enables the researcher to see things that participants themselves are not aware of.

In this study the observation that was undertaken was the unstructured observation. The reason for this approach is candidly expressed by Cohen, Manion and Morrison (2000) who state "an unstructured observation will be far less clear on what it is looking for and will therefore have to go into a situation and observe what is taking place before deciding on its significance for the research" (p. 305). In line with this, I did not use an observation schedule but wrote copious field notes arising from my observations.

In this study the researcher took on the role of observer-as-participant. Cohen, Manion and Morrison (2000) describe an observer-as-participant as, "is known to the group and has less contact with the group" (p. 310). Key (1997) suggests that this type of observation is passive participation, where the researcher is present at the scene of action but does not interact or participate. The role of the researcher in this study was to find an observation post and assume the role of bystander or spectator.

In this study the aim of the researcher was to obtain observation in the form of visual data, hence the video recording. Cohen, Manion and Morrison (2000) advise on audio-visual recording and state that with audio-visual recording the data is neutral whereas a researcher could become partial and observe only particular or frequent events. With the audio-visual recording it allows the researcher to look at the physical setting and the participants. It also allows the researcher to observe what the participants are doing and how the teacher sets out each lesson. The audio-visual observation permits the researcher to view the actions of the teacher and participants repeatedly. Observation that involves the researcher sitting in the classroom observing the lesson and making notes does not allow for repeated viewing. The researcher has to rely on her observations to make inferences.

## 3.7 TRIANGULATION AND TRUSTWORTHINESS

Key (1997) mentions that the purpose of corroboration is to assist researchers in enhancing their understanding of the likelihood that others will see their findings as credible or worthy of consideration. One process involved in corroboration is triangulation. Cohen, Manion and Morrison (2000) define triangulation "as the use of two or more methods of data collection in the study of some aspect of human behaviour" (p. 112). For the purpose of methodological triangulation, which involves different methods on the same object of study, document analysis of the CTA, document analysis of participants written responses to the CTA, interviews with participants and observation of the classroom exercise of the CTA were used in this study. The researcher did this because Cohen et al (2000) state that exclusive reliance on one method may bias or distort a researcher's view. In order to be confident about the data generated, they suggest methodological triangulation (that is multiple data sources).

In keeping with the theoretical framework of this study, which is constructivism, diverse constructions of reality were considered. Golafshani (2003) spells out that constructivism values multiple realities, which people have in their minds. So to acquire valid and reliable "multiple and diverse realities", multiple methods of searching or gathering data are "in order" (p. 604). Golafshani further emphasizes that an open-ended perspective in constructivism "adheres" with the notion of data triangulation and engaging multiple methods "will lead to more valid, reliable and diverse construction of reality" (p. 604).

This study has been strengthened by data and methodological triangulation. To assure reliability in qualitative research, consideration of trustworthiness is essential. The naturalistic criteria appropriate for judging the overall trustworthiness of a qualitative study are credibility, transferability, dependability and confirmability. The following table (Table 3.3) adapted from (Krefting, 1991, p. 219) indicates how these criteria were addressed in this study.

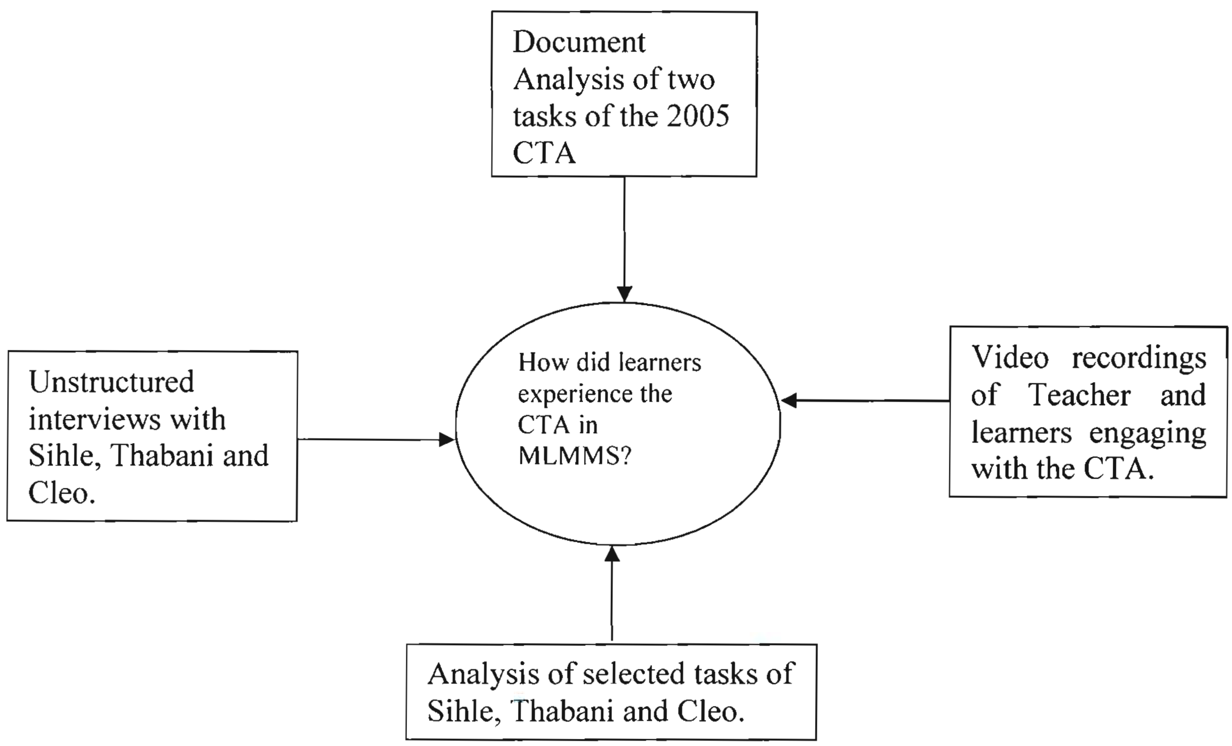
Table 3.3 Components with which to establish trustworthiness in this study

| Component | Criteria | Application |
|---|---|---|
| Credibility | Prolonged and varied field experience<br>Triangulation<br>Interview technique | Participants' written responses to the CTA, audio-visual observation. Data analysis of Department of Education CTA. Tape recording of interviews. |
| Transferability | Dense description | Verbatim quotes from interviews. Extraction of participants written responses to CTA. Audio-visual observation. |
| Dependability | Dependability audit<br>Triangulation | Transcripts CTA document<br>Participants' written responses to CTA. |
| Confirmability | Confirmability audit<br>Triangulation | Transcripts to be checked. Participants' written responses to be checked. CTA document to be checked. |

This accords well with Merriam's (2000) statement that "reliability lies in others' concurring that given the data collected, the results make sense- they are consistent and dependable" (p. 27).

### 3.8 ANALYSIS OF DATA

The following spider diagram shows the data analysis that was done in order to achieve the research purpose of finding out about the learners' experiences of the CTA. Learners written responses and interviews on the Common Tasks for Assessment is seen to play a central role in communicating how learners experienced the CTA based on real-context. It provides an insight on learners' views and experiences based on their understanding and general nature of their rules that they have constructed.




I collected 41 written responses of the Common Tasks for Assessment in Mathematics, Mathematical Literacy and Mathematical Sciences. Having read some of the responses I requested for volunteers to form the group of case study learners. The learners were eager to be part of the study. For convenience I requested for three volunteers. The three participants Sihle, Thabani and Cleo were interviewed as per appointment. The interviews were then transcribed. From the interview I was able to establish Sihle's, Thabani and Cleo's perceptions of the 2005 CTA.

Then Sihle, Thabani and Cleo's written responses of certain tasks were analysed. The school's department of mathematics had decided to only undertake two tasks of the 2005 CTA due to time constraints. These two tasks contained eight activities with sub questions. The three participants did not answer all the required activities, therefore certain activities that were common with the three participants were analysed. Also some activities that were not common to all participants were also analysed. The participants' written responses to the CTA and the participants' interviews formed an individual case analysis for each learner.

The 2005 CTA was analysed. The two tasks of the 2005 CTA were analysed using Poliah's moderating criteria (Poliah, 2003). This formed an analysis of an educational document.

The video recordings were viewed and noted. The observation of the video recording uncovered the role of the teacher.

The data analysis yielded rich data and provided answers to my research questions.

## 3.9 LIMITATIONS OF THE STUDY

In this study convenience sampling was used, where participants were from my own school. The sample in this study is small and does not permit the drawing of generalisations. Cohen, Manion and Morrison (2000) impart this view by stating, "as it does not represent any group apart from itself, it does not seek to generalise about the wider population" (p. 103). This view is supported by Merriam (2000) who states, "since small, non-random samples are selected purposefully in qualitative research, it is not possible to generalise" (p. 28).

I do believe that this study will highlight grade 9 learners' experiences with the CTA for MLMMS and its deductions. Merriam (2000) states, "the general lies in the particular;

what we learn in a particular situation we can transfer to similar situations subsequently encountered" (p. 28).

## 3.10 CHAPTER SUMMARY

In this chapter I outlined the main aspects of the research methodology, critical question and design used in my study. I presented the data collection techniques as well as how the data was analysed. Furthermore I presented triangulation and the limitations to the study.

# CHAPTER 4

# A CRITICAL ANALYSIS OF THE 2005 COMMON TASKS FOR ASSESSMENT IN MATHEMATICAL LITERACY, MATHEMATICS AND MATHEMATICAL SCIENCES

In this chapter, Task 1 and Task 2 of the 2005 Common Tasks for Assessment in MLMMS are critically analysed. The reason for doing this analysis is that it allows us a clearer vision of exactly what the participants in the study encountered. Furthermore, the CTA learner book was accompanied by a marking memorandum, which contained solutions and marking stipulations for all activities. So in order to understand the context of the study, it is necessary to look closely at the assessment tool itself. Firstly, the introductory features and the activities from Task 1 and Task 2 are analysed. Due to the late arrival of the CTAs, the school took a decision to answer Task 1 and Task 2 only. A second layer of analysis is then presented by using a framework based on the moderating criteria initially used by Umalusi and reported by Poliah (2003).

## 4.1 ANALYSIS OF SELECTED ACTIVITIES

Under this subsection I first present an analysis of the introductory aspects of the CTA, which is then followed by key points of individual activities from the two tasks.

This chapter has to be read in conjunction with the complete 2005 CTA and memorandum, which are provided in the Appendix A which is the CTA and Appendix B the memorandum.

### 4.1.1 Introductory Features

The Common Tasks for Assessment (CTA) in Mathematical Literacy, Mathematics and Mathematical Sciences (MLMMS) is in the form of a learner book, which is also the question paper. The instruction seems to provide the learner with information that is needed to answer questions in the CTA. Page 2 begins with descriptions of the categories:

Title, Phase Organizer, Programme Organizer and Focus. Immediately thereafter are four bullet points which seem to be instructions that are directed to the learner, concerning the time limits, where to write their responses, the need for explanations and an explanation that the activities could be answered as individuals, in pairs or in groups. The time constraint instruction states, "This CTA should be completed within FIVE hours, which may be spread over a number of days". My concern when I read this point was that the statement could be misinterpreted as a choice to carry out the entire CTA in one day or spread across several days. However it would be impossible to complete the CTA within one day.

The learner is then introduced to the icons used in the activities and their meanings, for example the icon of the 'light bulb'. However from the four icons that are presented, two of them do not appear in a single activity or at the beginning of any task. The contents indicate the pages where the four tasks begin. The third page has a glossary of 16 words.
In my view the list is not comprehensive enough. Learners would need help with words or phrases such as "environmental management techniques", "game" (in this context), "game reserve", "additional person supplements", "species", "prohibited", just to mention a few that are not part of the learners' everyday vocabulary, but which appear in the CTA.

### 4.1.2 Task 1

The instructions for Task 1 contain a description of what learners will be assessed on. The theme of this task is National Parks. Task 1 consists of activities 1.1, 1.2, 1.3 and 1.4. I will now highlight pertinent issues related to each of these activities.

*Activity 1.1*

Activity 1.1 is a group activity consisting of 4 questions, none of which were allocated any marks. I would like to raise three points with respect to activity 1.1. The first point concerns the discussion of activity 1.1. The purpose of these questions seems to set the scene for the context. It is not clear why there were set questions instead of having an open discussion with learners so that the questions could come from them.

The second point concerns the flow of questions. The first two questions are open-ended questions, and do not make any reference to the map. The third and fourth questions needed information provided in the map. Activity 1.4, which came later on, required information from the map. In my view it would have made pedagogic sense to cluster question 3 and 4 with activity 1.4 to ensure a consistent flow and to direct learners' attention to the map when it was necessary.

My third point is that the scale used on the map (see scale below) could be confusing because on the right of the map from 0 to 400 is a continuous line while to the left from 0 to 400 is made up of two short lines. In my experience, inconsistencies like these may inadvertently create confusion amongst learners.

(courtesy www.SANparks.org)

*Activity 1.2*

This activity with four questions is to be completed in pairs. Two points arise with respect to this activity. The first point is that learners are provided with examples on how to answer the questions. The learners are expected to follow the example when answering the question. This approach of providing a stipulated method on how to answer the question does not allow for a variety of responses. Furthermore this restriction of the method is better suited to individual activity rather than working in pairs (as specified at the beginning of the activity). In my view the idea of working with a partner implies that each would provide their own interpretation and share their meanings about the question. This suggests that the decision on whether an activity was described as individual work or to be done in pairs or groups was not based on the nature of the activity.

The second point I want to raise, concerns a discrepancy with the memorandum for question 1.2.3. According to the memorandum the length of the line for 1.2.3 is 45mm. However there are three possible answers. If the line is measured excluding the end points (the diamond shape) the value is 42,5mm. If the line is measured excluding one end point then the value is 45mm. If the line is measured including the two end points then the value is 48 mm. Since there was no instruction about whether learners should include the end points or not, there are three different possible values. A learner would have been disadvantaged if the teacher followed the memorandum strictly, as will be demonstrated in the case of Sihle in chapter 5.

*Activity 1.3*

Activity 1.3 has two questions, which involved working in pairs. For activity 1.3.1 learners had to present the units of measure in a table. In addition to that they had to provide written examples or draw models of each unit according to its actual size. One concern is that the memorandum was restricting. It did not allow for a variety of responses. For example, the example for *km* is given as "the length of 10 soccer/rugby fields" and the example for $m^2$ is given as "slightly more than half a standard door". Both these examples were based on assumptions that learners were familiar with a standard door and the length of soccer/rugby field, which may not be the case. Furthermore the memorandum does not advise teachers to allow for a variety of responses, which may have disadvantaged learners who provided other examples that teachers may not have recognised, as will be demonstrated in the case of Thabani in chapter 5.

A second concern is the vagueness of the instructions provided for question 1.3.1. The instructions contained eight requirements to be satisfied in order to answer question 1.3.1. The instruction also required learners to use the table provided in question 1.3.2 to answer question 1.3.1. It would make more sense to have done question 1.3.2 first, and to then draw information from the table. A related concern in this activity was the readability of the instructions, which will be discussed later in Section 4.2.1 under the category of language. For question 1.3.2 learners were required to convert from one unit of measurement to another. A further concern about this activity is that it involves 10 repetitive conversions of which only one is required for activity 1.4.

*Activity 1.4*

This is an individual activity with five questions. In my view, this activity required learners to be proficient in the English language to work through the activity. They had to read carefully and extract the important mathematical requirements of each question. For example question 1.4.5 has approximately 50 words excluding the numbers. For this question the learner was provided with a large amount of information and the mathematical demand of this question was to calculate the percentage increase of the park. A related concern in this activity was the readability of the instructions, which will be discussed later in this chapter.

Overall for Task 1, the five mathematical demands, namely, scale, calculation of area, conversion, estimation and calculation of percentage increase are embedded in 14 questions, one classification table and one conversion table, appearing across 3 pages.

### 4.1.3 Task 2

The theme of this task is touring the Kruger National Park. This task begins with a description of what learners will be assessed on. It is stated that activities in task 2 are based on the information found on pages 7 & 8. Actually some important information was found on page 9 as well. This task consisted of activities 2.1, 2.2, 2.3 and 2.4.

*Activity 2.1*

Activity 2.1 is an individual activity worth five marks. The information for this activity is scattered across 3 pages. The question to this activity is on page 9. Table 3, which is needed to answer this question, is on page 7. However the learner also has to read the critical information such as "Adult is 12 years or above" which is found on page 7 and the first half of page 9 to establish the fact that there are 22 girls and 18 boys. Altogether the learner had to read 239 words. This is a large amount of information to answer the following question. *'Calculate the minimum amount that could have been paid for the accommodation at Skukuza rest camp. The boys were accommodated in unit type "camping" and girls in unit type "safari tent".* My concern is that the time and effort that is required to answer this question is not consistent with the mark allocation of 5 marks.

Furthermore Table 3 contained a large amount of extraneous information that learners needed to ignore. Also, information on page 7 contained words such as "additional person supplements", "communal", "tariffs", and "bungalow". These are specialised English words, which only make sense in the context of subjects such as travel, tourism or accounting, and are not within the everyday vocabulary of the average South African Grade 9 learner. A phrase such as "additional person supplements" would only be understood by those learners who had the opportunity of going for holidays where the accommodation arrangements contained such stipulations, whereas other learners who did not have such experiences would not have understood the phrase, because it is specific terminology.

*Activity 2.2*

This activity consists of two questions. For question 2.2.1 learners had to investigate the rates of changes in prices. I would like to raise five points concerning this question. Firstly this question required learners to calculate rates of change for six different unit types. This implies that they had to carry out the same type of calculation six times over. The concern here is that if the learner incorrectly calculates the first rate of change then it is possible that the learner carries that error to the remaining calculations and will be penalized 6 times for one error.

Secondly the memorandum for this question provides a table with six columns although the question does not provide an instruction on the design and headings that are required. The allocation of marks is tightly linked to the organization of the table.

Thirdly, nowhere does the instruction state that one of the columns in the table should be a 'check' column, yet the memorandum allocated marks for this. It is not clear why there was a need for a 'check' column when it was not asked for in the question, and it did not appear in any other calculation exercises. It is also not clear why this question warranted this special 'check' treatment. Mysteriously all the participants in the study produced the exact table shown in the memorandum. More details on this are found in chapter 5.

Fourthly, the instruction to this question is not clear. "Investigate the rate at which the tariffs for ...." It is not clear whether the rates for each of the 6 units are being sought or whether the average increase (by considering the total) is required. However the memorandum reveals that what was required were 6 calculations, which result in the same value when they are rounded off to the nearest R5. There is an instruction in the question that follows (question 2.2.2) that the tariffs should be rounded off to the nearest R5.

Fifthly, the question to this activity does not provide any instructions on how many decimal places have to be considered when calculating rate of change. However in the memorandum in some cases the rate of change is written to two decimal places, sometimes three and even four decimal places. For example, the tariff for "Safari tent" is R230 and the rate of change is 1,043, but when the check is done, it is done using two decimal places. Using two decimal places gives an answer of R239, 20 which was mysteriously rounded off to R240, although it should be R239 if it was rounded off to the nearest rand. However when checking if R230 is multiplied by the rate of 1,043 (three decimal places) it gives an answer of R239, 80 which can be rounded off to R240. The instruction does not ask for rounding off nor does it indicate the required number of decimal places to be used to maintain consistency.

Furthermore the memorandum does not allow for alternative methods. To illustrate this point, I will consider the checking of the calculation of the "safari tent" tariff. The increase is R10, which is 4, 35% of R230. To check whether the rate gives you the amount, the new price is 4, 35 divided by 100, times R230 = R10. New price is R230 + R10 = R240. There is much more accuracy in this method.

For question 2.2.2 learners were required to use the values from question 2.2.1 to round off to the nearest five. From Table 3 the only information the learners used was "safari tent" and "camping" units for accommodation. It would have been preferable to restrict both the questions to the two unit types instead of calculating rates for all unit types.

*Activity 2.3*

This is an individual activity worth 9 marks consisting of four questions.

For this activity, the information required by learners is found on page 8. The questions appear on page 10. Learners have to repeatedly flip over to page 8 for crucial information.

The first point I want to raise about this activity is that three out of four questions required the learners to calculate time. Secondly, the activity relied heavily on the distance table that was amongst a large amount of information found on page 8. Nowhere did the instruction to this activity draw attention to the distance table. One possible approach would have been for learners to directly measure the distance from the map and then convert that measured distance to actual distance. This would have been a cumbersome and an inaccurate method that could have been inadvertently encouraged by question 1.1.3, which asked learners for the location of their school on a map, as well as question 1.4.1 that asked for an estimation of the distance from the school to Kruger National Park. In fact the teacher was misled as well and asked learners to measure the distance from the map but later realised her mistake. More details of this are found in chapter 5. To ensure validity of the question, the task designers should have directed or limited the learners' attention to the distance table. Thirdly question 2.3.2(b) required learners to calculate the time of arrival at Lower Sabie Rest Camp. However the place of departure is not provided in this question and learners may not realise that the place of departure was given in question 2.3.1.

*Activity 2.4*

For this activity learners, had to use the information from the tally table to draw a bar graph. This activity is very close to many such activities appearing in most textbooks and is also similar to ones usually presented in class work.

For task 2 the mathematical demand was to read information from tables and maps; use information to make informed decisions; investigate rates of change; do calculations involving speed, distance and time and translate a tally table to a bar graph. To meet these mathematical demands, learners needed to answer 9 questions. A further concern is that there was a large amount of information for the task, which was found to be scattered across three pages.

## 4.2 A CRITICAL OVERVIEW OF THE 2005 CTA

In this overview of the 2005 CTA I will use a framework drawn from the criteria used by Umalusi to moderate the CTAs (Poliah, 2003). Below is a brief description of the 6 criteria used by Umalusi. My framework makes use of these 6 criteria. However criteria 4 and 5 have been collapsed into one criterion regarding assessment. A further criterion concerning the memorandum was then added. The memorandum criterion was added because an instrument cannot be moderated in the absence of the marking memorandum, since teachers had to mark tasks according to the memorandum provided. There was no other supporting document or guidelines on what should be discussed or clarified with learners.

### 4.2.1 Umalusi's moderating criteria

According to Poliah (2003), Umalusi used set criteria to moderate the CTA's.

The following criteria were concentrated on during the moderation process:

- Content: accuracy, relevant appropriate and interesting?
- Standard: appropriate for Grade 9 learner?
- Use of language: easily accessible and free of bias?
- Variety as regards forms of assessment?
- Appropriateness of forms of assessment to the task/activity?
- Diagrams, pictures, graphics, etc, clearly marked and easily readable?

These criteria will now be used as a basis to analyse the 2005 MLMMS CTA. For each of the 6 criteria, I will first name them and then briefly describe the pertinent factors considered under the particular category.

*Content*

This criterion refers to relevance, accuracy and appropriateness of the mathematical content used in the CTA. In this category I consider the accuracy and relevance of the content in Task 1 and Task 2. The mathematical content for these two tasks are using scale, calculating area, conversions, estimations, percentage increase, using tables and maps, investigating rates of change, calculations involving speed, distance and time and data handling. The mathematics that is being tested is part of the Grade 9 Mathematics syllabus; therefore it is accurate and appropriate for Grade 9. In terms of accuracy, all the content covered was accurate.

However there are two points that I want to raise in terms of relevance to the content. The first point pertains to the relevance of the scale that is given on page 4. Learners are required to measure the distance from their school to the Kruger National Park and then convert that measurement by using the scale provided on page 4. According to the memorandum 'x' is the measurement in cm from 0 to 400. In the memorandum the 'x' is placed on the right side of the scale and not on the left hand side, hence what is the relevance of providing the extraneous information that is not used? Secondly what is the relevance of Activity 1.1? This activity was not allocated any marks and the order of the questions had no flow to it.

*Standard*

This criterion considers whether the standard of the CTA is appropriate to Grade 9. Under this category I consider the levels of questions and the indication of the mark allocation for individual questions. An important issue is the different levels of questions. According to a document provided by the mathematics subject advisor during a meeting, the taxonomical differentiations of questions in Mathematics are:

- Level 1 – Knowledge
- Level 2 – Routine procedures
- Level 3 – Complex procedures
- Level 4 – Problem solving. (DoE, 2007, p. 7)

Furthermore Knowledge or Knowing type questions should constitute 25% of the assessment, 30% should be allocated to Routine problems which in most cases consolidates the knowledge of concepts, another 30% for Complex problems and 15% for Problem solving.

Is the CTA appropriate for grade 9 learners? I argue that the CTA is appropriate for those learners who are able to extract the mathematics and ignore the context. By setting all the questions within a context, many low-level mathematics questions get transformed into higher-level problems. The inclusion of contexts requires sifting and extracting of information, which results in an overload of problem solving and too few questions, which could be answered by the majority. Also in keeping with the requirements of the Department of Education the CTA, which is externally set, should have been allocated 15% problem solving.

With respect to the way in which the mark breakdown was indicated, there is inconsistency. For example in task 1, activities 1.2 and 1.3 have no marks allocated for sub questions, yet activity 1.4 has a clear distribution of 17 marks across 5 sub questions. In task 2, activities 2.2, 2.3 and 2.4 have sub questions and there is no indication as to how the marks are distributed for sub questions. The CTA is externally set and therefore has to maintain consistency in order to maintain a high standard of quality.

*Language*

Under this category I consider whether the written language as well as the language permeating the CTA is easily accessible and free of bias. Under this category I considered several aspects related to the language of the instruction as well as the language used in the information presented. In order to see whether the information presented was easily accessible and free of bias, I was concerned with the language being part of the everyday vocabulary, the clarity of instructions, the overload of words and the readability of the instructions.

Firstly, the concern about language used in the CTA is whether the language is accessible to all learners and whether the language of the CTA is part of the learner's everyday vocabulary. The CTA is appropriate for those learners who are proficient in English. If it is compulsory to use English then the language should be as simple as possible. The CTA has long sentences with the mathematics embedded in these sentences. Words such as "moratorium" and "sustainable" are not common words used in everyday conversation. The language used in any assessment should be accessible to all learners. Mathematics has its own language with words such as calculate, estimate, convert. Combining the mathematical language with English in this case creates conflict for the user of the CTA.

The second point in terms of language is the overload of words. Question 1.4.5 has approximately 50 words (including numbers and abbreviations). Learners will have to be proficient in English to be able to extract the critical information of calculating percentage increase. Another activity that has an overload of words is activity 2.1. For this activity, information is scattered across two and half pages containing 237 words. In activity 1.4 the learners were required to calculate area, to convert from one unit to another, explain estimation and calculate percentage increase. Four out five assessments for task 1 were allocated to this activity and this activity contained all the mathematical demands embedded in the context of the Kruger National Park. For example, in question 1.4.5 (see Appendix A, page 6) the learner has to calculate percentage increase. For this question the learner had to read, interpret and understand 50 words for calculating percentage increase. The assumption here is that learners are familiar with the context of the Kruger National Park.

The third point is that of the clarity of instructions. In question 1.3.1 learners are required to present the units of measurement in a table. However the instruction given is vague. It required learners to list, classify, write out names in full and draw or make a model. An example of what was required was not provided so the instruction was open to interpretation. Another example is activity 2.2. This activity had two questions. The instruction given for question 2.2.1 was that the findings must be presented in a table; yet again the instruction failed to state how many columns were needed. The memorandum provided a column for check and marks were allocated for checking. However the instructions failed to provide this information.

Related to the point about clarity of instructions, is the whole question about readability of instructions. Were the instructions understandable to an average Grade 9 learner who is furthermore more likely to experience English as a second language? When writing a textbook, a test or an examination paper, the writer's objective is to transmit information to the reader. According to Johnson (2008), a poor reader will become discouraged by texts that are difficult to read fluently. Some of the reasons that affect readability are that some text may be poorly printed, some texts may contain complex sentence structures and lastly some texts may contain complex words or too much material containing new ideas.

The words and sentences chosen by an author can affect readability. This factor is particularly important to this study because the CTA is a common test set by the Department of Education. The author/s of the CTA is the Department of Education. According to Weitzel (2003), the readability of a document is the most easily proven. In order to calculate the readability of a document there are many readability formulas. The following are a few of the most widely used readability formulas. The Flesch-Kincaid Formula, Fry's Readability Graph, Gunning Fog Index and the Dale-Chall Readability Formula.

Rudolf Flesch devised the Flesch- Kincaid Formula. The Flesch-Kincaid Formula is automatically calculated on Microsoft word documents. After Microsoft Word completes a grammar check (under tools in the tool bar), readability statistics are displayed. Allan, McGhee and Krieken (2005) state that Flesch-Kincaid is useful in rating educational materials. The Flesch Reading Ease scale was designed for adult materials and the Flesch Kincaid Grade level Index was designed to check manuals produced for the United States armed services. In the Flesch Reading Ease test, higher scores imply that the material is easy to read and lower scores indicate it is harder to read. The formula for the Flesch reading Ease Score (FRES) test is 206.835 – (1.015 × ASL) – (84.6 × ASW) where:

ASL = average sentence length (the number of words divided by the number of sentences).

ASW = average number of syllables per word (the number of syllables divided by the number of words).

Table 4.1 Mapping of Flesch Reading Ease score to Readability level.

| Flesch Reading Ease Score | Readability Level | Estimated School Grade Completed |
|---|---|---|
| 0 – 29 | Very difficult | college |
| 30 – 49 | Difficult | High school or some college |
| 50 – 59 | Fairly difficult | Some high school |
| 60 – 69 | Standard | $7^{th}$ or $8^{th}$ |
| 70 – 79 | Fairly easy | $6^{th}$ |
| 80 – 89 | Easy | $5^{th}$ |
| 90 – 100 | Very easy | $4^{th}$ |

Allan et al state that scores of 90-100 are considered easily understandable by a $5^{th}$ grader, while $8^{th}$ and $9^{th}$ grade students could easily understand passages with a score of 60-70. Furthermore Allan et al articulate that the reading level expresses the grade of education a reader needs to understand the information. This refers to adults. They also add that most people read at a sixth or eight-grade level. Therefore they strongly advocate that materials designed to educate readers, need to be easy to read.

Considering the last point I would like to present 3 questions and part of the information that appears on page 7 from the 2005 CTA. The questions are part of question 1.3.1, 1.4.5, 2.2.1 and a paragraph appearing on page 7.

Question 1.3.1
Use Table 2 to discuss units of measurement, their purpose and their actual size.
Present the information in table form using appropriate headings as follows:
List all units of measurement mentioned in Table 2.
Classify them according to their purpose (measuring distance, area or volume).

Question 1.4.5
According to an agreement with the governments of Mozambique and Zimbabwe, the Kruger National Park will become part of the Greater Limpopo Transfrontier

Park. The eventual size of this park will be 100 000 km$^2$. Calculate the percentage increase of this park compared to the size of the Kruger National Park before 1994 (2 149 700 ha).

Excerpt from page 7
Accommodation in the Kruger National Park
Skukuza, "the capital of the Kruger National Park", offers visitors a unique experience. Skukuza is by far the largest camp in the Park with over 200 huts, with shops, a restaurant, a movie theatre, doctor's rooms, a petrol station, and a huge camping area, etc. It resembles a small town rather than a rest camp!

Question 2.2.1
Investigate the rate at which the tariffs for accommodation have been increased from 2004/2005 to 2005/2006. Show all your calculations. Present your findings in tabular form by adding columns to Table 6.

Table 4.2 Summary of Readability Statistics

| | Q 1.3.1 | Q 1.4.5 | Paragraph On page 7 | Q 2.2.1 |
|---|---|---|---|---|
| Flesch Reading Ease | 51% | 32.4% | 55.9% | 33.5% |
| Flesch – Kincaid Grade Level Index | 8.9 | 12.0 | 10.0 | 11.3 |

The above readability statistics appears in Word when the Tools menu on the top of the toolbar of Microsoft Word screen is pulled down and spelling and grammar is chosen. After a spell check a screen appears with readability statistics.

According to the Flesch Reading Ease a score of 50 implies that the document is fairly difficult while a score of 63.4% indicates that the document is of a standard level. Another set of statistics supplied by the computer is that of grade level. According to the above statistics, question 1.3.1 is suitable for a grade 9 learner, while question 1.4.5 is suitable for a learner of grade 12 and above education and question 2.2.1 is suited to a grade 11 learner. However earlier Allan, McGhee and Krieken (2005) stated that most people read at a sixth or eight-grade level. Firstly they refer to adults when they raise this point and secondly their reference is to adults in the United States. In comparison to this study, the people in this study are children under the age of 15 and English is not their first language. Therefore an activity such as question 1.4.5 would be beyond comprehension for most adults let alone learners. The score of 50 is an indication of the difficulty of the question. The paragraph has a reading ease of 55, 9, which is considered to be fairly difficult.

To conclude Johnson (2008) states that a reading level measured for example for a 7$^{th}$ grader predicts that the passage would be at the limit of the comprehension ability of the average 7$^{th}$ grader. The reason is that most readability formulae are based on a 50% correct answer score in a comprehension test. Implying that if a piece of text has a reading level of 7$^{th}$ grade, then an average 7$^{th}$ grader will only score 50% on a comprehension test of that particular text. Therefore even though the reading ease of question 1.3.1 is 51% and is suitable for some high school learners, however it does not imply that learners will have full comprehension of the text.

*Variety of forms of assessment*

This category is drawn from a combination of two of Poliah's criteria cited above and considers whether the CTA contains a variety of forms of assessment and whether the form of assessment is appropriate for the question. In Umalusi's moderating criteria, variety of forms of assessment and appropriateness of forms of assessment are presented as two separate categories. However they have been combined into one category because variety and appropriate forms of assessment are interdependent.

The forms of assessment used in the CTA are class work, assignment, homework and investigation but do not appear as information in the CTA. Therefore the requirement of providing a variety of forms of assessment is satisfied in the CTA. However, what are absent are directions about the forms of assessment and assessment method. The activities do not clearly state whether the activities are classwork or an investigation and whether the activity will be peer assessed or teacher assessed.

The appropriateness of forms of assessment is questioned. The first example I want to present is question 1.2. This question stipulated the method that had to be used. The question was to be answered as class work and peer assessed and this information appears in the memorandum but not in the CTA. The marks allocated for this question is 5 and by being peer assessed implies that the answers are provided and learners mark each other's responses. This type of assessment disadvantages the learners because with calculations a learner may make a human error and maintains continued inaccuracy which a learner may not be able to establish as an error but which a teacher could.

Another example, activity 1.3, is a class work activity with peer assessment. This activity was worth 5 marks. This activity required clarity of instruction and the requirement of this task were not simple and straightforward. Learners provided a variety of responses to this activity and yet the memorandum was restrictive as to what was expected of the activity. An activity that is open to different interpretations is better suited to assessment by the teacher who can judge the various approaches, rather than peers who will not be able to recognise different options.

The last activity that I want to discuss is activity 2.1. This activity was given as a homework activity. The information provided in this activity was based on the assumption that learners will realise that options are differentiated by price. Also learners needed to have an understanding of such terms as "base occupancy", "additional person cost" and be able to read the table found on page 7. The time and effort demands of this task, which had information scattered across many pages, was not consistent with the mark allocated for this task, which was 5 marks.

The CTA had four tasks, which comprised of 13 activities. The 13 activities of which 3 were either carried out in groups, 4 in pairs and 5 as an individual activity.

In the CTA there are indicates the marks allocated for 13 group, 16 pair and 71 individual activities out of 100 marks. It is clear that although the CTA encourages group activity and pair activity, the value attached to these activities is 29% while a higher value of 71% is attached to individual work.

*Diagrams and other Visual Information*

Under this criterion I analysed the visual information, which includes diagrams, pictures, maps, etc, to see whether they were clear and easily readable. In this category I was concerned with the readability of diagrams, pictures, tables and graphics. Furthermore I looked at whether the diagrams, etc were clearly marked.

The CTA used the following visual graphics.

47 oblique-shaped information icons,


4 task icons,


13 icons indicating a new activity,

2 Maps, 1 graph, 10 tables, 8 photographs and

4 Blocks pertaining to assessment.

In this task you will be assessed on your ability to:

- Use a scale to determine actual distances between two points on a map.
- Calculate area.
- Convert from one unit to another.
- Explain estimations.
- Calculate percentage increase.

There are 90 visual pieces of information in this CTA contained across a number of pages relating to 13 activities. This is an overload of visual content. The visual content is clear, however clarity and readability of diagrams, maps, etc will depend on each individual and their interpretations of the visual content. In activity 2.4 the photographs of the animals were not strictly necessary because learners needed to draw a bar graph from the information provided. Learners were not required to identify animals from the photograph or interpret the photograph.

My concern is that this overload of visual information may have distracted learners from, or at least delayed them in, understanding instructions. The participants in this study were not accustomed to tasks being displayed in this manner and were more accustomed to paper and pencil test items (as revealed by a survey of their test books). Of course the question of whether the visual information provided in the CTA particularly is more harmful than helpful, would need further study.

*Memorandum*

This category was added to the list of criteria because I consider the memorandum to be equally important to the CTA and also needs to be moderated. In this category I consider a few points pertaining to the memorandum. Under this category there are three points I want to raise.

Firstly, in the memorandum there is an inconsistency with the solution for question 1.2.3. There was no instruction provided for this question and yet the memorandum provides a value for the line concerned. A closer inspection of the line provides three possible values for the line. The solution provided in the memorandum actually takes one end point into consideration to arrive at a value of 45mm. With no instructions provided on how to measure the line, therefore 45mm is one possibility. However if the memorandum is strictly adhered to without the teacher actually working out the solutions, then this can be disadvantageous for the learners because one of the possibilities can be marked as incorrect.

Secondly, question 1.3.1 is a question that is open to interpretation, yet the memorandum provided set solutions and is restricting. The memorandum does not provide further instructions that there are other possible solutions to this question. Once again this can be disadvantageous to learners.

Thirdly, in a question such as question 2.2.1 there is an inconsistency between the question and the memorandum. The question requires learners to calculate the increase. The instructions to this question are both vague and ambiguous. The learners could calculate the increase from one year to another or calculate the rate of increase. However the instruction does not mention a column for checking yet the memorandum provides a column for checking.

*Context*

This category was added because the CTA has both content and context. However the mathematical content is embedded in the context. Therefore it is necessary to look at the accuracy, relevance and appropriateness of the context as well.

## 4.3 CHAPTER SUMMARY

In this chapter I presented an analysis of two activities from the 2005 CTA. I also presented the moderating criteria used by Umalusi and used the criteria to overview the CTA.

# CHAPTER 5

# ANALYSIS

In this chapter, the analysis is presented with the intention of providing a picture of the participant's experience of the CTA of this study. This is a qualitative study, and therefore the analysis of each case is examined separately. Firstly I present the three cases, which were drawn up from data consisting of the interviews, learners' written responses and the observation of the of the teacher's interventions. The second part of this chapter is devoted to a summary description of the teacher's interventions over four days.

In the analysis of data, direct written responses from learners' CTA's as well as direct quotations from transcripts are used. Written responses were used as they appeared in learners' answer booklets, that is, their spelling or grammatical errors were not corrected. The individual interviews were transcribed verbatim. Learners' grammatical errors were maintained when quotations from the interview were used.

In order to differentiate between the three participants and to maintain anonymity and confidentiality, they are referred to as Sihle, Thabani and Cleo.

## 5.1 PRESENTATION OF INDIVIDUAL CASES

In the analysis of the three individual cases, each case begins with a profile of the learner. When analysing each learner's written response, I consider the score that the response was worth as compared to the marking memorandum. Thereafter, the learners' perception of the CTA is elaborated by presenting their responses to the interviews.

### 5.1.1 Sihle's case

Sihle is a 15-year-old African male learner. He lives in Illovo but attends Starwood Secondary School. Sihle lives with his parents and is the youngest of 5 children. Although his home language is isiZulu, he uses English as a medium of communication.

Sihle's performance in mathematics in Grade 9 is that of an average student. He achieved a continuous assessment mark of 42/75which converts to 56%. Sixty seven percent of the continuous assessment is carried out under strict examination conditions, which minimizes or even eliminates the possibility of learners copying. This implies that although Sihle is an average student in Mathematics, he is capable of passing Mathematics, a Grade 9 learning area. Sihle wrote the Common Tasks for Assessment (CTA) and achieved a mark of 20/54, which is 37%. The irony of the situation is that the CTA was undertaken as a class exercise. Learners engaged in the CTA sometimes as a group or on an individual basis. Learners were also allowed to take the CTA's home and complete tasks that they were unable to complete in the classroom. Despite being allowed to take the CTA home, Sihle still performed poorly. However assessments written under examination conditions are proof that he is capable of achieving a pass in the Mathematics.

Sihle attempted six out of the eight activities. The following is an analysis of four activities from Sihle's written response. They are activity 1.2, activity 1.3, activity 2.1 and activity 2.2.

I now consider his responses to each of the 4 questions.

*Activity 1.2*

The following is the question and marking suggestions for activity 1.2. These also appear in the appendices.

| Scale | Distance measured on map | Actual distance |
|---|---|---|
| 1 mm is 1 km | 50 mm | $\frac{50mm}{1mm} \times 1km = 50km$ |
| 1 mm is 10 km | 28 mm | 1.2.1............ |
| 1:100 | 40 mm | $40mm \times 100 = 4\,000mm$ |
| 1:100 000 | 3 cm | 1.2.2............ |
| 20 40 80 km<br>x | y | $\frac{y}{x} \times 20km =$ |
| 20 40 km | | 1.2.3............ |
| (Try more than one scale)<br>1.2.4.................. | 20 mm | 40 km |

*Figure 5.1*

| Act no | Possible answers | Mark allocation | | Marks | |
|---|---|---|---|---|---|
| 1.2.1 | $\frac{28mm}{1mm} \times 10km = 280km$ | Multiplying 10 km by 28<br>Correct answer | 1 mark<br>1 mark | | |
| 1.2.2 | 3 cm x 100 000 = 300 000cm | Multiplying 3cm by 100 000<br>Correct answer | 1 mark<br>1 mark | | |
| 1.2.3 | $\frac{45}{15} \times 20km = 60km$<br>(providing the dimensions did not change during the duplicating process. Even so the answer should still be 60 km) | Measuring distances x and y correctly<br>Dividing the two numbers in the correct order<br>Correct answer | 2 marks<br>1 mark<br>1 mark | | |
| 1.2.4 | 1:200 000 or<br>1 mm is 2 km or<br>20 40 km | Any acceptable version of a scale | 2 marks | 10 | $\frac{10}{2}$<br>5 |

*Figure 5.2*

I am going to consider Sihle's response to activity 1.2. This was worth 5 marks.

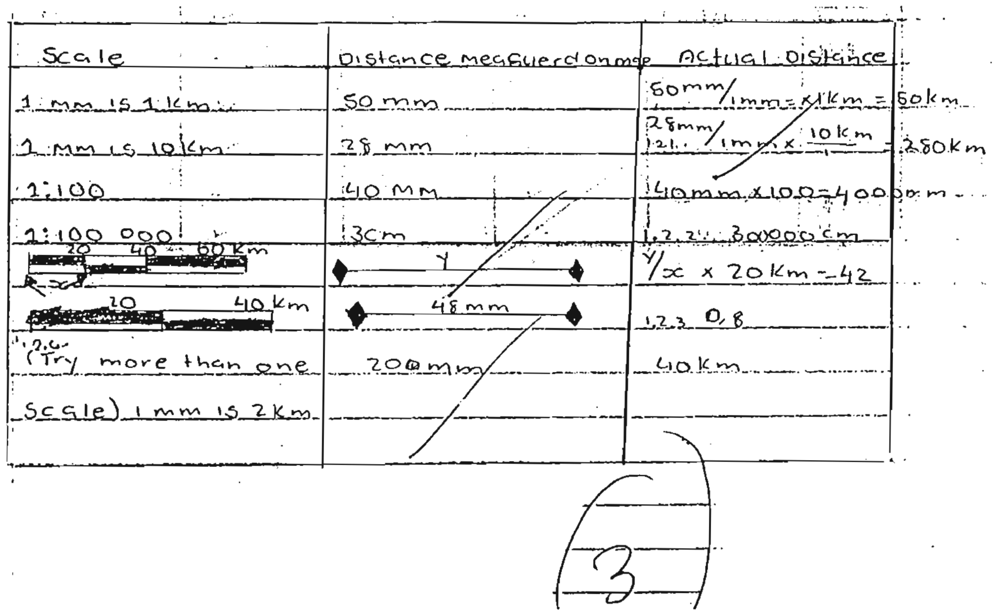



*Figure 5.3*

Question 1.2.1. Sihle's answer of 280km was correct, but he was allocated 2 marks, instead of the 1 mark stipulated in the memorandum.

Question 1.2.2. His answer of 300 000cm is worth 1 mark only because there were no working details, but he received no marks.

Question 1.2.3. Sihle wrote an answer of 0, 8 without showing any working details. However he provided one measurement of 48mm of the line. For this question he was given 1 mark.

Question 1.2.4 Sihle's response was 1mm is 2km. Sihle's answer is accepted because the memorandum states "any acceptable version of a scale", and he was given the full 2 marks allocated to this question.

Altogether he achieved 5 marks for this question. The marks were then divided by 2. He achieved 2½, which were rounded off to 3. Note that the activity received three ticks, which seem to have haphazardly been placed by the teacher. The first tick is for an example provided in the activity. The second tick is on the value 48mm and not at the question 1.2.3. And the third tick is at a blank spot.

*Activity 1.3.1*

The following is the question and marking suggestions for activity 1.3.1.

You also need to know how to convert between units of distance, area and volume.

1.3.1 Use Table 2 to discuss units of measurement, their purpose and their actual size.

Present the information in table form using appropriate headings as follows:

- List all units of measurement mentioned in Table 2.
- Classify them according to their purpose (measuring distance, area or volume).
- Write out their full names.
- Draw or make a model of each unit according to its actual size. If the unit is too big to draw or model, give an example (describe in words) of something the size of that unit.

***Figure 5.4***

<table>
<tr><th>Act no</th><th>Possible answers</th><th>Mark allocation</th><th>Marks</th></tr>
<tr><td>1.3.1</td><td>
<table>
<tr><th>Distance</th><th>Area</th><th>volume</th><th>Full name</th><th>Example</th></tr>
<tr><td>mm</td><td></td><td></td><td>millimetre</td><td>-</td></tr>
<tr><td>cm</td><td></td><td></td><td>centimetre</td><td>———</td></tr>
<tr><td>m</td><td></td><td></td><td>metre</td><td>The same as the half the height of a standard door</td></tr>
<tr><td>km</td><td></td><td></td><td>kilometre</td><td>The length of 10 soccer/rugby fields</td></tr>
<tr><td></td><td>$mm^2$</td><td></td><td>square millimetre millimetre squared</td><td>□</td></tr>
<tr><td></td><td>$cm^2$</td><td></td><td>square centimetre centimetre squared</td><td>□</td></tr>
<tr><td></td><td>$m^2$</td><td></td><td>square metre metre squared</td><td>Slightly more than the area of half a standard door</td></tr>
<tr><td></td><td>$km^2$</td><td></td><td>square kilometre kilometre squared</td><td>The area of 100 soccer/rugby fields (1000mx1000m)</td></tr>
<tr><td></td><td>ha</td><td></td><td>hectare</td><td>The area of a soccer/rugby field. (100mx100m)</td></tr>
<tr><td></td><td></td><td>$cm^3$<br>$m\ell$</td><td>cubic centimetre centimetre cubed<br>millilitre</td><td></td></tr>
<tr><td></td><td></td><td>$m^3$</td><td>cubic metre metre cubed</td><td>The volume of a big box - as high as half the height of a standard door with the same length and breadth. (1mx1mx1m)</td></tr>
<tr><td></td><td></td><td>$\ell$</td><td>litre</td><td>The volume of any 1 $\ell$ bottle</td></tr>
</table>
</td><td>
**Classifications:**<br>7 or more correct 2 marks<br>Less than 7 correct 1 mark<br><br>**Full names:**<br>7 or more correct 2 marks<br>Less than 7 correct 1 mark<br><br>**Examples:**<br>7 or more correct 2 marks<br>Less than 7 correct 1 mark
</td><td>6</td></tr>
</table>

***Figure 5.5***

This is Sihle's interpretation of question 1.3.1

Sihle's 1st response to question 1.3.1

| Measure | Distance | Area | Volume | Full name | Model |
|---|---|---|---|---|---|
| M | ✓ | – | – | Metres | A 10m B |
| $Cm^2$ | – | ✓ | – | centimetres | |
| Mm | ✓ | – | – | Millimeters | 1 mm |
| Km | ✓ | – | – | Kilometres | |
| $Cm^3$ | – | – | ✓ | Centimetres | 1-2-3-4-5-6 |
| Ml | ✓ | – | – | millilitres | |

*Figure 5.6*

Sihle's 2nd response to question 1.3.1

| Distance | Area | Volume | Full name | Example |
|---|---|---|---|---|
| Mm | $Mm^2$ | $Mm^3$ | Millimetres | |
| Cm | $Cm^2$ | $Cm^3$ | Centremeters | |
| M | $m^2$ | $M^3$ | Metres | |
| Km | $Km^2$ | $Km^3$ | Kilometres | |
| | | | | |

3

*Figure 5.7*

Sihle received 3 marks for his interpretation of activity 1.3.1

In his solution he provided two tables. For table 1 he received a tick but no mark. For table 1, Sihle deserves 1 mark for classification. According to the memo if a learner has less than 7 classifications, then the mark allocation is 1 mark. For full names he deserves another mark because the memo allocates 1 mark for 7 or less. For examples, according to the memo, Sihle does not deserve any marks because his examples do not reflect an understanding that is required from the memo.

For table 2 Sihle deserves 1 mark. Sihle used 'm' to indicate that he was working with distance, which is linear. He then used '$m^2$' to indicate area, which is quadratic, and '$m^3$' to indicate volume, which is cubic. Sihle received 3 marks for this activity although his solution for table 2 differed from the memo.

It is clear that Sihle's interpretation and answers differed from the examiners. Sihle drew 3 small lines of almost the same length and indicated m, mm or cm. In the memo an actual size of a mm is drawn. The same for cm. However in the memorandum for the metre the following answer is provided. The same as "half the height of a standard door". With reference to Sihle's table 1; his example for a kilometre is the sketch of a road. In the memorandum the example of a kilometre is given in words "the length of 10 soccer/rugby fields". The memo has not allowed for a consideration of a variety of responses such as the one provided by Sihle. Sihle's example for 'ml' is a sketch of a small bottle (refer to table 1). However for this unit of measure, the memorandum does not provide an example of a millilitre.

Sihle also provided a second solution to activity 1.3.1. Table 2 is his second solution. It is not clear as to why he provided two tables for his solution to activity 1.3.1. Looking at the 2nd table gives one the interpretation that Sihle may have had second thoughts about his interpretation to activity 1.3.1. However the teacher observations suggested that he was more likely to have been influenced by the teacher's directions. More details of this will be found in chapter 5 under 5.2.

Another point to note is that Sihle did not receive any mark for table 1, although his table 1 contains classification, the full names as well as the required drawings. It is not clear why he drew a second table, which according to the memo was incorrect. However for the incorrect response he received 3 marks. Actually he deserved 2 marks for the first table because that was his first response and it was much closer to what was expected. This is an example of the inconsistency, which was apparent in the teachers marking.

*Activity 2.1*

The following is the question for activity 2.1 and marking suggestions as well as Table 3

Use table 3 to complete this activity. Calculate the minimum amount that could have been paid for the accommodation at Skukuza Rest camp. The following factors should be taken into account:

- the boys were accommodated in unit type "Camping" and
- the girls in unit type "Safari Tent".

***Figure 5.8***

**TARIFFS FOR ACCOMMODATION**

**Tariffs are from November 2004 to October 2005**

**KEY: CK** = communal kitchen **K** = Hotplate and sink **DB** = Double bed

| Unit type | No. of units | Tariffs per unit per day | Base occupancy | Max. beds | Tariffs for an additional adult | Tariffs for an additional child |
|---|---|---|---|---|---|---|
| | | 2004/05 | | | 2004/ 05 | 2004/ 05 |
| Camping | 80 | 100,00 | 1 - 2 | 6 | 35 | 17,00 |
| Safari Tent – communal facilities | 12 | 230,00 | 1 - 2 | 2 | N/A | 36,00 |
| Safari Tent – communal facilities | 8 | 230,00 | 1 – 2 | 4 | 70,00 | 35,00 |
| Bungalow CK | 117 | 460,00 | 1 – 2 | 2 or 3 | 100,00 | 50,00 |
| Bungalow K | 61 | 495,00 | 1 – 2 | 2 or 3 | 100,00 | 50,00 |
| Luxury Bungalow | 5 | 770,00 | 1 – 2 | 1 DB | N/A | N/A |
| Luxury Riverside Bungalow | 15 | 885,00 | 1 - 2 | 1 DB | N/A | N/A |
| Family Cottage | 1 | 850,00 | 1 - 4 | 4 | N/A | 180,00 |
| Guest Cottage | 6 | 850,00 | 1 - 4 | 4 | N/A | 180,00 |
| Guest Cottage | 7 | 850,00 | 1 - 4 | 6 | 180,00 | 180,00 |
| Guest Cottage | 2 | 850,00 | 1 - 4 | 6 (2 DB) | 180,00 | 180,00 |
| Guest House *Moni* | 1 | 1600,00 | 1 - 4 | 8 | 300,00 | 300,00 |
| Guest House *Nyathi, Waterkant 1* | 3 | 1600,00 | 1 - 4 | 8 (2 DB) | 300,00 | 300,00 |
| Guest House *ABSA* | 1 | 1600,00 | 1 - 4 | 12 (4 in lounge) | 300,00 | 300,00 |

(courtesy www.SANparks.org)

Table 3

*Figure 5.9*

| Act no | Possible answers | Mark allocation | Marks | |
|---|---|---|---|---|
| 2.1 | 18 Boys: 3 Camping units: (max 6 per unit)<br>Base occupancy 3xR100 = R300<br>Additional costs: 12xR35 = R420<br>Total: R720 | Correct number of camping units 1 mark<br>Correct cost for base occupancy 1 mark<br>Correct number of boys paying additional costs 1 mark<br>Correct costs for boys 1 mark | | |
| | 22 Girls: 6 Safari units 4 girls in 5 units and 2 in one unit.<br>Base occupancy 6xR230 = R1380<br>Additional costs: 10xR70 = R 700<br>Total: R2080 | Correct number of safari units 1 mark<br>Correct base occupancy cost 1 mark<br>Correct number of girls paying additional costs 1 mark<br>Correct costs for girls 1 mark<br>Correct total cost 2 marks | | $\frac{10}{2}$ |
| | Total cost: R720 + R2080 = R2800 | | 10 | 5 |

*Figure 5.10*

This is Sihle's response to activity 2.1

| unit type | 2004/2005 | 04/05 | 04/05 | | | |
|---|---|---|---|---|---|---|
| ① camping | 100,00 | 35 | 17,00 | 2,85/170 | 2,86 x 17 | 48,45 |
| ② safari tent | 230,00 | 36,00 | | | 6,38 x 36 | 229,68 |
| | | | | | | R278,13 |

2

*Figure 5.11*

Sihle used a table to answer activity 2.1 even though the question did not require the answer to be tabulated. Sihle's table consisted of 7 columns, the same number as Table 3. Note that the headings for the first 4 columns were taken directly from Table 3 with some information left out. From his solution provided above, one can note that he has extracted certain figures from Table 3. For unit type camping, Sihle extracted the values of 100, 00; 35 and 17, 00 from row 1 of Table 3 which is Figure 5.9.

The values of 2, 85 and 170 do not appear anywhere in table 3. However if 100 is divided by 35 it is equal to 2.857. It is not clear where the 170 came from. Possibly it is related to 17. or Sihle meant to write 17, 00 and wrote 170 and forgot to put in the decimal. Column 6 has 2, 85 × 17, which is carried forward as 48, 45 in column 7. The link between the columns is that 100 and 35 are used to derive the value of 2, 85. The 17, 00 from column 4 was used to multiply with 2, 85 to arrive at the value of 48, 45. 17, 00 from Table 3 is the additional cost for a child. Thirty-five is an additional cost for an adult. According to the information provided, an adult is anyone who is 12 years and older. Therefore from Table 3, Sihle had to ignore the rate attached to the child.

The information that 18 boys needed accommodation for the camp unit type was not noted in Sihle's response. Also that each camp costs R100, 00 for 2 people and R35 extra per person was not taken into account. However he pulled R100, 00 and R35 out and used it in his own way to create something out of what was in the table. He probably did not understand the information provided in Table 3 Figure 5.9. The cost for one camp, which will accommodate six people, is R240. Since there are 18 boys the cost would be 240 x 3 which is equal to 720. The answer Sihle provided for the camp unit type was 48, 45. It indicates that Sihle's interpretation of the question and his reading of the information from Figure 5.9 led him to an incorrect solution because he was not able to understand the information provided in the table.

From Figure 5.9 he continued to provide a solution for the unit type safari tent. Once again in column 1 he wrote safari tent. In column 2 he wrote 230, 00. In column 3 he wrote 36, 00. Column 4 and 5 are blank, possibly because column 4 in table 3 has N/A. In column 6 he wrote 6, 38 x 36. The numbers 230 and 36 have been taken out from table 3. However 6, 38 does not appear in table 3 but Sihle repeats the method he used to derive the 2, 85 in the first row. 230 divided by 36 equals 6, 38. This 6, 38 is then multiplied by 36 to arrive at the value of 229, 68. This amount of 229, 68 is the amount, according to Sihle, it would cost to accommodate 22 girls in 'Safari tents'. According to the memo the cost for accommodating 22 girls in safari tents is R2080. Nowhere in his solution does he indicate 22 girls nor does he use 22 in his calculations. His entire solution to activity 2.1. does not make any reference to 18 boys and 22 girls. Neither was 18 or 22 used in his calculations indicating that he did not extract this information about the number of people who required accommodation.

One reason that Sihle may have overlooked the number of people who required accommodation is that, to answer this question, Sihle needed to read all the information on page 7 including Table 3 as well half of page 9. A second reason is that he did not understand the information presented in the table, because he used numerical information in a way, which did not make sense. Also what was absent from his solutions for this activity was the 'rand' in front of the answers. For example he wrote 229, 68 and not R229, 68. One possible reason is that he extracted values directly from the table.

In comparison to the memorandum, Sihle's solution was completely off the mark. There were no similarities to indicate that those are answers to one and the same question. He received 2 marks out of 5 for this activity. In actuality he deserved no marks. If this is so then this has an implication on his final mark. His final mark would decrease by two. He initially achieved a mark of 20 out of 54. If one incorrect mark is removed from task 1 and 2 from activity 2.1. This implies that Sihle actually achieved 17 out of 54, which would reduce his mark to 31%.

*Activity 2.2.1*

For this activity learners had to use the following table, which is followed by the question for activity 2.2.1. The memorandum is also provided.

This table also includes tariffs for the 2005/2006 season

| Unit type | Tariffs | |
|---|---|---|
| | 2004/05 | 2005/06 |
| Camping | 100,00 | 105,00 |
| Safari Tent – communal facilities | 230,00 | 240,00 |
| Bungalow CK | 460,00 | 480,00 |
| Bungalow K | 495,00 | 515,00 |
| Luxury Bungalow | 770,00 | 800,00 |
| Luxury Riverside Bungalow | 885,00 | 920,00 |

Table 6

2.2.1 Investigate the rate at which the tariffs for accommodation have been increased from 2004/2005 to 2005/2006. Show all your calculations. Present your findings in tabular form by adding columns to Table 6.

***Figure 5.12***

| Act no | Possible answers |
|---|---|
| 2.2.1 | **Investigating the increase in rates:** |

| Unit type | Tariffs | | | | |
|---|---|---|---|---|---|
| | 2004/05 | 2005/06 | Rate of change | Check | Rounded off |
| Camping | 100,00 | 105,00 | $\frac{105}{100} = 1,05$ | 100x1,05=105 | 105 |
| Safari Tent – communal facilities | 230,00 | 240,00 | $\frac{240}{230} = 1,043$ | 230x1,04=239,20 | 240 |
| Bungalow CK | 460,00 | 480,00 | $\frac{480}{460} = 1,043$ | 460x1,04=478,40 | 480 |
| Bungalow K | 495,00 | 515,00 | $\frac{495}{515} = 1,0404$ | 495x1,04=514,80 | 515 |
| Luxury Bungalow | 770,00 | 800,00 | $\frac{800}{770} = 1,039$ | 770x1,04=800,80 | 800 |
| Luxury Riverside Bungalow | 885,00 | 920,00 | $\frac{920}{885} = 1,0395$ | 885x1,04=920,40 | 920 |

***Figure 5.13***

This is Sihle's response to Activity 2.2. Question 2.2.1

| 2004/2005 | 2005/6 | rate of change | check | rounding off | |
|---|---|---|---|---|---|
| 100,00 | 105,00 | 105/100 = 1,05 | 1,05x100 = ~~105~~ | 105,00 | |
| 230,00 | 240,00 | 240/230 = 1,04 | 1,04x230 = | 240,00 | |
| 460,00 | 480,00 | 460/480 = 1,04 | 1,04x460,00 | 480,00 | |
| 495,00 | 515,00 | 495/515 = 1,04 | 1,04x495 | 515,00 | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

***Figure 5.14***

3

Sihle's table has six columns. The first two headings in his table appear in table 6 as columns 2 and 3. The headings 'rate of change', 'check' and 'rounding off' is not part of table 6. However Sihle provides the correct headings as well as the correct response to this question with the exception of the third answer in column 3 of his table. His solution has the correct numbers as is in the memorandum, except the denominator and numerator are interchanged.

*In summary*: From Sihle's response to the four activities, it is evident that he experienced difficulty with the questions. He was not able to provide correct responses to activity 1.3.1 and activity 2.1. He extracted numbers from table 3 and tried to make sense of those numbers, while for activity 2.2.1 he was able to provide correct headings as well as correct solutions. The marking of Sihle's responses shows inconsistencies.

*Sihle's perceptions of the CTA*

The interview with Sihle provided an insight into his perceptions of the CTA. In the following summary, verbatim sentences have been extracted so as not to lose the essence of some of Sihle's comments.

*Researcher:* Is there anything you would like to say about the CTA.
*Sihle:* Yes. But it was a Monday when my teacher my maths teacher came in and gave us. She told us to open to the first activity and start learning how to do it.

We continued with our conversation and then I picked up on the statement about some words being difficult. I then posed a question.

*Researcher:* What does tariffs for accommodation mean?
*Sihle:* No mam I don't understand it. Cos mam since I've entered school I've never come across a heading like that.
*Researcher:* It is the cost that is charged for staying in a place, for example a hotel. When people go on holidays they stay at different places and they have to pay for staying in these places.

The opportunity arose and I asked Sihle if he had been on a holiday.

*Researcher:* Have you been on a holiday.
*Sihle:* Yes mam, to my aunty's house in Port Shepstone.
*Researcher:* How long do you stay at your aunty's?
*Sihle:* If it is July holidays, I stay for two weeks and for December I stay the whole holidays.

Sihle's interpretation of holiday coincides with the school holidays, not once did he make reference to a 'holiday' that involved making preparations for buying a plane ticket or the cost of the holidays or a particular destination other than a relative's home. According to Sihle, a holiday implies school holidays and a holiday implies spending the school holiday with a relative.

With reference to table 5 on page 8 of the 2005 CTA.

| | |
|---|---|
| *Researcher:* | Please read off from the table the distance from Olifants to Satara. |
| *Sihle:* | No mam, I can't read from this table. |
| *Researcher:* | Why can't you read from the table? |
| *Sihle:* | I don't understand it mam. |

When I explained to Sihle that the CTA was based on grade 9 work.

| | |
|---|---|
| *Researcher:* | The CTA is based on grade 9 work. |
| *Sihle:* | In maths our teacher normally teach us. They give us like sums for us to calculate. They'll only give us distance not distance with words. Like the activity we saw which has words for us to read and then we have to calculate distance as you were saying from Olifants to Satara. We were never given a task like that. |

We continued our conversation and I allowed him to talk about the CTA. Whenever the opportunity arose I would ask him to elaborate. At the end of the interview I wanted to know if he had any parting words.

| | |
|---|---|
| *Researcher:* | Is there anything you would like to say before we stop. |
| *Sihle:* | Yes. For the CTA I would say now those who like the department of education shouldn't just send it mam. Not all pupils are very intelligent. They should not be sending such hard things for pupils, which they know some pupils may lack from schoolwork just because not understanding what is going on. And for a teacher mam, the teacher must not just come and leave the CTA on the table without explaining it to the pupil. First the teacher has to explain the CTA to the pupil so that the pupil can give him or herself time to learn how to do the CTA. |

Sihle's parting words seems to imply that the CTA was difficult not because the learners did not know the mathematics but it was rather a problem of not understanding what was expected.

*In summary*: Sihle was upset about the tasks in the CTA having so many 'words'. He preferred sums. He was also upset that the teacher did not do enough to assist him and the learners with the CTA. He was not able to provide an explanation for the word "tariffs" which is an indication that it is not part of his experience. He also commented that the department should not send a difficult CTA.

### 5.1.2 Thabani's case

Thabani is a 15-year-old African male learner presently studying in Starwood Secondary. His home language is Xhosa. He lives with his grandmother in Montclair. This is his paternal grandmother. His grandmother works as a live-in maid. Thabani has been living with her since entering high school. During the school holidays he goes to the Eastern Cape to spend time with his father, stepmother, two stepsisters and one stepbrother. He has not met his mother since birth. He has always lived between two homes, his grandmother and his father's.

Thabani participates in sport, is a class representative on the School Representative Council for Learners (SRCL) and serves on the SRCL as an executive member. He also participates in interclass debates in English. He is also the captain of the junior debating team in English and participates regularly in interschool debates. He also participates in various Mathematics challenges. In grade 08 he received a gold certificate for the Old Mutual Mathematics Challenge. In grade 09 he reached the second round but did not continue due to illness.

As a mathematics learner, his results are excellent. The following are the results he obtained in examinations that were held under controlled conditions. The results are in percentages.

Table 5.1 Thabani's Examination Results

| Examination | Result |
|---|---|
| March Control | 86% |
| June | 92% |
| September Control | 100% |

These marks are an indication of Thabani s capabilities as a Mathematics learner.

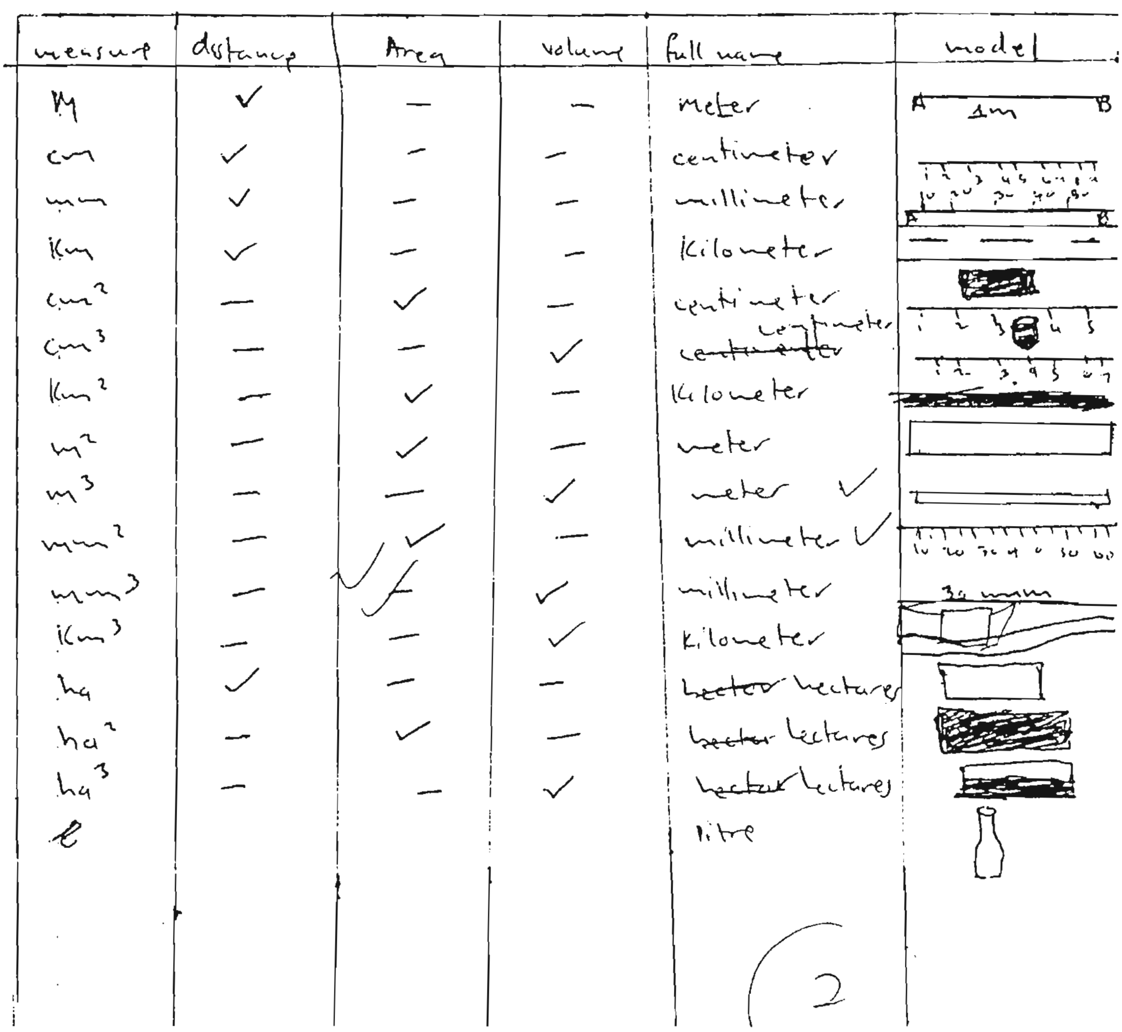
In the CTA, Thabani obtained $\frac{27}{54}$ which is 50%.

Let us now focus on how Thabani responded to activities in the CTA. I will focus on three activities namely activity 1.3.1, activity 2.1 and question 2.2.1 to investigate how Thabani experienced the CTA.

*Activity 1.3.1*

The question and memorandum for this activity is provided in Sihle's response.

This is Thabani's interpretation of activity 1.3. Question 1.3.1



| measure | distance | Area | volume | full name | model |
|---|---|---|---|---|---|
| m | ✓ | — | — | meter | A 1m B |
| cm | ✓ | — | — | centimeter | |
| mm | ✓ | — | — | millimeter | |
| km | ✓ | — | — | kilometer | |
| cm² | — | ✓ | — | centimeter | |
| cm³ | — | — | ✓ | ~~centimeter~~ centimeter | |
| km² | — | ✓ | — | kilometer | |
| m² | — | ✓ | — | meter | |
| m³ | — | — | ✓ | meter ✓ | |
| mm² | — | ✓ | — | millimeter ✓ | |
| mm³ | — | ✓ | ✓ | millimeter | 30 mm |
| km³ | — | — | ✓ | kilometer | |
| ha | ✓ | — | — | ~~hector~~ hectares | |
| ha² | — | ✓ | — | ~~hector~~ hectares | |
| ha³ | — | — | ✓ | ~~hector~~ hectares | |
| ℓ | | | | litre | |

2

*Figure 5.15*

Thabani's interpretation of this question and his solution differs considerably from the expected answer. For each unit of measure he provided a name, its use, for example 'm' stands for metre and it is used for distance. He provides a sketch of a line segment with two end points and labels it as 1m. However in the memorandum m, which stands for metre, is in a specific column, which is the distance column, and instead of a model, an explanation is given. The explanation is "the same as the half the height of a standard door". For $km^2$ Thabani provided the sketch of something that was shaded. It is not clear what he was attributing $km^2$ to. However the memorandum provided an explanation for $km^2$, which is "the area of 100 soccer/rugby fields".

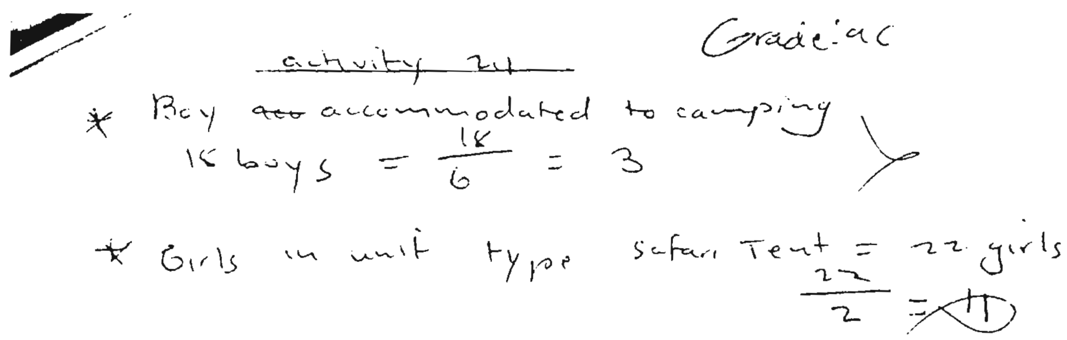
Thabani is an intelligent pupil who has produced good mathematics results but despite that, he has not answered in a manner, recognised by the memorandum. However he has clearly shown an understanding of the type of units, which are appropriate to measure area. For example, for $mm^2$ and $m^2$, he has drawn 2D shapes such as rectangles. For the cm and mm he has drawn a ruler with measurements given cm or mm. For the km he has drawn a thick line to show that it was a linear measure, not to be confused as 2D. For $km^3$ he has attempted to draw a single cuboid.

To demonstrate a litre he has drawn a bottle, showing his understanding that litres are measures of volume. His approach is completely opposite to the memorandum specifications. He received two marks for this activity. Possibly he deserves more marks because he demonstrates an understanding. However it is not clear if the teacher once again assigned marks haphazardly or if she followed the memorandum and used her discretion to attribute the marks.

*Activity 2.1*

The question and memorandum for this activity appears in Sihle's case.

The following is Thabani's response to activity 2.1


activity 2.1 Grade: 9C

* Boy ~~acc~~ accommodated to camping
18 boys = 18/6 = 3

* Girls in unit type safari Tent = 22 girls
22/2 = 11

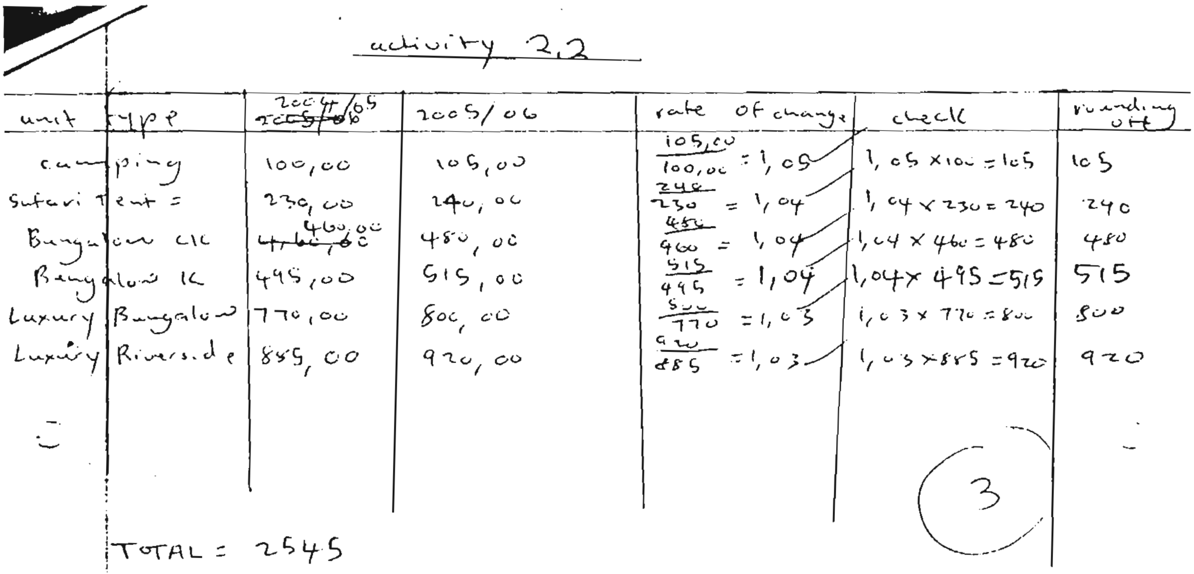
*Figure 5.16*

From Thabani's response to this activity it is evident that he was able to correctly establish that 22 girls and 18 boys needed accommodation. Once again it is evident that there are inconsistencies in the teachers marking. Although the memorandum does not allocate marks for 18 boys and 22 girls, however these two values are critical for the calculation of the minimum cost.

However he didn't complete his answer to the question. The question needed a minimum amount that could be paid for accommodation. From his response it is apparent that he worked out the first part, but was stuck at the subsequent steps, which needed him to make choices or make sense of the information given in the table. Since the boys needed to be accommodated on campsites, he extracted the value of 6, which is in the column for max. beds. He then divided the number of boys by the number of beds, resulting in the answer of 3. The only explanation one can derive from this calculation is that he established that the boys needed 3 camping units. He repeated the process but looked at the first safari tents and obtained a value of 2 for maximum beds. He divided 22 by 2 and got a value of 11. Under unit types, safari tents appear twice.

To make an informed decision for the best cost, learners need to look at both the safari units and determine how many units of each they need to accommodate the girls. From Thabani's solution it seems the girls needed 11 safari tents at a cost of R2530. He ignored the second safari tent information. He did not provide any further calculations and there was no cost in his solution. Thabani's response revealed that he did not fully understand table 3 of Figure 5.9. The assumption behind the question is that learners will know that different options will result in different costs. However for learners who have not had holidays at various places, this consideration of different options is only understood from experience. Thabani's experiences of a holiday did not include weighing up different options.

The following is Thabani's response to activity 2.2 question 2.2.1



activity 2.2

| unit | type | ~~2005/06~~ 2004/05 | 2005/06 | rate of change | check | rounding off |
|---|---|---|---|---|---|---|
| camping | | 100,00 | 105,00 | $\frac{105,00}{100,00} = 1,05$ | 1,05 × 100 = 105 | 105 |
| Safari Tent = | | 230,00 | 240,00 | $\frac{240}{230} = 1,04$ | 1,04 × 230 = 240 | 240 |
| Bungalow CK | | ~~4,60,00~~ 460,00 | 480,00 | $\frac{480}{460} = 1,04$ | 1,04 × 460 = 480 | 480 |
| Bungalow IK | | 495,00 | 515,00 | $\frac{515}{495} = 1,04$ | 1,04 × 495 = 515 | 515 |
| Luxury | Bungalow | 770,00 | 800,00 | $\frac{800}{770} = 1,03$ | 1,03 × 770 = 800 | 800 |
| Luxury | Riverside | 885,00 | 920,00 | $\frac{920}{885} = 1,03$ | 1,03 × 885 = 920 | 920 |

TOTAL = 2545

3

***Figure 5.17***

*In summary:* Thabani is an excellent mathematics learner who, it seems, experienced problems with the CTA. He provided a solution for activity 1.3.1 that differed from the memorandum and yet his solution demonstrated a deep understanding. For activity 2.1 he was able to extract critical values for the first step but because he did not fully understand table 3, he did not continue. There is also evidence of inconsistencies in the marking.

*Thabani's perception of the CTA*

The interview with Thabani provided an insight to his perceptions of the CTA. Large excerpts are used verbatim from the interview because it conveys a better understanding of how Thabani experienced the CTA.

When Thabani and I began a conversation about the CTA, our conversation began as follows:

*Researcher:* there anything you would like to tell me about the CTA you wrote for maths.

*Thabani:* Yes. I would like to talk about the CTA. The first time I saw it, it was very difficult for me to relate to the questions and it was something I have never done before. I did make an attempt but some of the questions I wasn't able to answer them.

*Researcher:* What was the problem?

*Thabani:* You see the problem is we have never actually done problem solving in maths. You see that is basically my problem. I wasn't, I was not able to understand what was the questions.

*Researcher:* What made the questions so difficult that you could not understand? You are a very good maths student. So why did you have a problem?

*Thabani:* Just the way it was written.

*Researcher:* How was it written?

*Thabani:* The language.
*Researcher*: What about the language?
*Thabani:* The words. Most of the time I understand the sums. I think sums are more better than problem solving. It would have made a big difference if the CTA was written in sum. It would have been better.
*Researcher*: It would have been better if it were written in sums instead of words?
*Thabani*: Yes.
*Researcher*: When it is written in words, what happens to you?
*Thabani:* I am unable to relate what they are asking us to do.
*Researcher*: Could you explain to me, what is a straightforward problem?
*Thabani*: What can I say? Ah. If I can say, if you have to calculate a length of a beacon, that would be better. Just tell me to calculate. Don't write it in between words and the language. The words the language makes it more complicated.

I posed a question, "How did you feel when you were answering a question that had no sums in it or like you said normal maths?"

*Thabani:* I was under a lot of pressure. Because just being me and not being able to answer the questions. A lack of understanding just makes you feel stupid about yourself. But with the CTA it seems like almost the questions were like difficult. I wasn't quite certain what I was writing.
*Researcher*: If you could change the CTA. I want you to help me set a CTA. How would you help?
*Thabani:* I would prefer to set a CTA with sums in it so the students can do all the sums. The normal maths.

*In summary:* Thabani did not like the language of the CTA. He did not like the continuous use of words in the CTA. A CTA with words is not 'normal maths'. Normal maths has sums and not words. Being a good mathematics student he felt he was under pressure. He felt he was 'stupid' because he had a lack of understanding. He also experienced anxiety when attempting the CTA.

### 5.1.3 Cleo's case

Cleo is a 15-year-old African female learner. Cleo resides in Umlazi and travels by train to Starwood Secondary. She lives with her mother who is unemployed and receives a social welfare grant. Cleo is an average student in mathematics. Her results in mathematics are as follows:

Table 5.2 Cleo's Examination Results

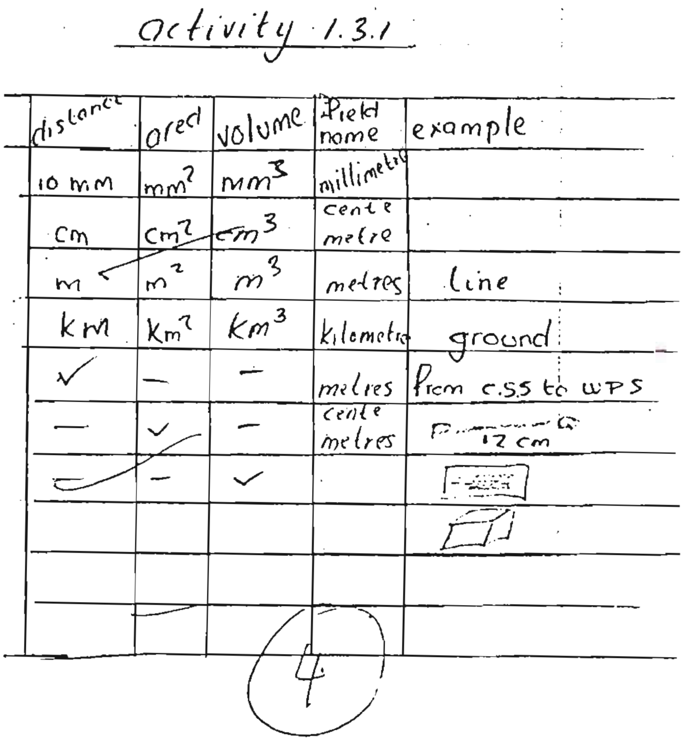
| Examination | Result |
|---|---|
| March Control | 40% |
| June Examination | 40% |
| September Control | 60% |

These results are obtained under strict controlled conditions. She obtained $\frac{15}{54}$ for the CTA, which converts to 28%. Cleo answered 6 out of 8 activities. She answered activities in part only. I am going to analyse five activities of Cleo. The activities are activity 1.3.1, activity 1.4, activity 2.1, activity 2.2.1 and activity 2.3.

*Activity 1.3.1*

The question and memorandum for this activity is provided in Sihle's response.

This is Cleo's interpretation of activity 1.3. Question 1.3.1


activity 1.3.1

| distance | area | volume | field name | example |
|---|---|---|---|---|
| 10 mm | $mm^2$ | $mm^3$ | millimetre | |
| cm | $cm^2$ | $cm^3$ | centemetre | |
| m | $m^2$ | $m^3$ | metres | line |
| km | $km^2$ | $km^3$ | kilometre | ground |
| ✓ | — | — | metres | from c.s.s to w.p.s |
| — | ✓ | — | centemetres | 12 cm |
| — | — | ✓ | | |
| | | | | |
| | | | | |
| | | | | |

4

***Figure 5.18***

Cleo received 4 marks for the interpretation of activity 1.3.1. The teacher's inconsistent marking is clearly evident Cleo's response. Two ticks imply that the mark is 2. This then has to be divided which would result in 1. In this case the mark has doubled.

In her solution Cleo provided a table with five columns. She used the following headings, distance, area, volume, field name and example. Cleo then used 'mm', 'cm', 'm' and 'km' for distance. She maintained the same unit of measurement but squared it to indicate area and cubed it to indicate volume. For the first four units of measure she provided a full name, however it is not clear why she labelled the column 'field name'. She provided a full name for mm as millimetre, which confirms that 'field name' implies 'full name'. It is possible that because Cleo is a second language English speaker, she heard the words 'full name' and when she recalled the words, 'field name' was written down. This reveals that Cleo did not see a difference between 'full name' and 'field name'. Instead of model, Cleo wrote example. No example was given for 'mm' and 'cm'. She then provided an example for 'm' by writing a single word. She repeated that for 'km'. Thereafter there are no measurements in the first three columns but she repeated two names in the fourth column. Cleo then provided an example, which read 'from C.S.S. to WPS'. This example is probably describing our school (which is often referred to as CSS) to another place and made sense to Cleo as an appropriate example for a kilometre. Cleo also ticked the first three columns at three different places, which does not make any sense as what the ticks are referring to.

In the example column, Cleo provided a line segment with the measurement of 12cm. This was in response to the 'full name' centimetre from the previous column. However she also provided two sketches, one in two dimensions and the other in three dimensions. These two sketches are isolated and make no reference to any measurement. This gives one the impression that Cleo may have realised that she needed to provide examples of sketches, hence the sketches with no reference to any unit of measure. The sketches provided and their placing in the table is an indication that Cleo was not sure of how to answer this question.

*Activity 1.4*

The following are the question and memorandum for activity 1.4

1.4.1 (a) Use the map on page 4 to estimate the distance from your school to the marked entrance to the Kruger National Park. (5)

(b) Why can the answer in (a) only be an estimation? Give two reasons. (2)

1.4.2 When the CTA was copied at a certain school the map on page 4 was reduced to 80%. What influence can this have on your answer in 1.4.1? Explain your answer. (3)

1.4.3 Up to 1994 the KNP stretched 350 km along the Mozambican border and was on average 60 km wide. Use this information to determine the approximate area of the Park before 1994, in km$^2$. (2)

1.4.4 According to one source, the actual area of the Kruger National Park before 1994 was 2 149 700 hectares. Convert your answer from 1.4.3 to hectares and explain why your answer differs from the actual area. (2)

1.4.5 According to an agreement with the governments of Mozambique and Zimbabwe, the Kruger National Park will become part of the Greater Limpopo Transfrontier Park. The eventual size of this Park will be 100 000 km$^2$. Calculate the percentage increase of this Park compared to the size of the Kruger National Park before 1994 (2 149 700 ha). (3)

***Figure 5.19***

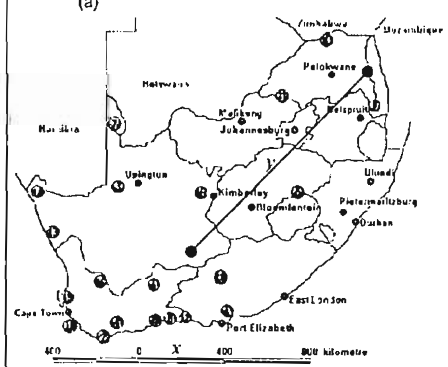
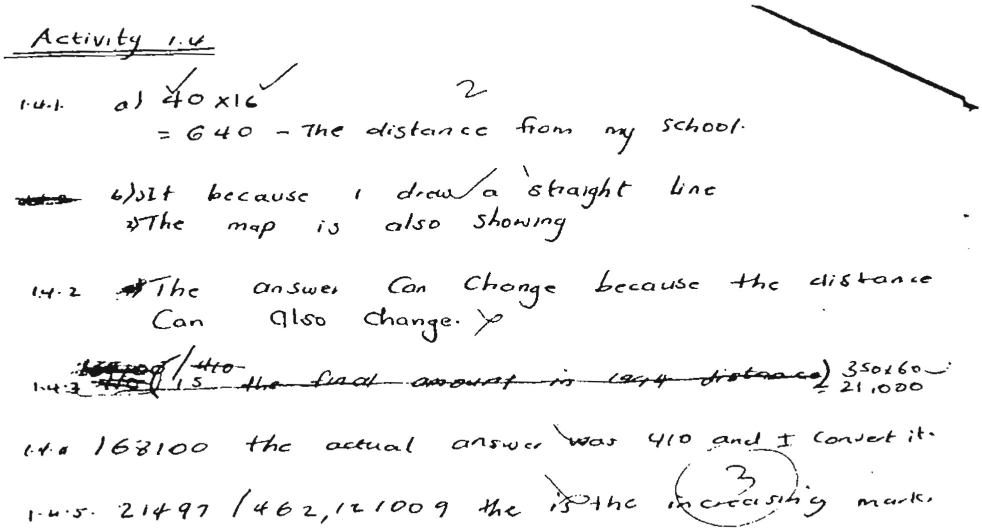
| Act no | Possible answers | Mark allocation | Marks | |
|---|---|---|---|---|
| 1.4.1 | (a)   | Plotting the school's position fairly correctly, i.e. correct province, towards the east, west, north, south, etc. 1 mark<br>Measuring the distance, y, from the school to the gate accurately. 1 mark<br>Measuring the distance, x, on the scale correctly 1 mark<br>Calculating $\frac{y}{x} \times 400km =$ correctly 2 marks | | |
| | (b) Estimation because:<br>Location of school and gate is an estimate.<br>Roads do not follow straight lines. | 1 mark for each reason 2 marks | 7 | |
| 1.4.2 | No influence.<br>Both y as well as x will be 80% of the original size and therefore the ratio $\frac{y}{x}$ will remain the same | Correct answer 1 mark<br>Reason 2 marks | 3 | |
| 1.4.3 | Area = 350km x 60 km = 21 000 km$^2$ | Multiply two distances 1 mark<br>Correct answer 1 mark | 2 | |
| 1.4.4 | 21 000 km$^2$ = (21 000 x 100) ha = 2 100 000 ha<br>The KNP is not a rectangle.<br>The two dimensions given are averages. | Correct answer 1 mark<br>1 mark for any appropriate reason 1 mark | 2 | |
| 1.4.5 | Percentage increase.<br>$\frac{10\,000\,000}{2\,149\,700} \times 100 = 465{,}18\%$ | Converting one of the areas to the same unit as the other 1 mark<br>Dividing in the correct order 1 mark<br>Correct answer 1 mark | 3 | 17 |

***Figure 5.20***

This is Cleo's response to activity 1.4



Activity 1.4

1.4.1. a) 40 x 16
= 640 - The distance from my school.

b) it because I drew a straight line
The map is also showing

1.4.2 The answer can change because the distance can also change.

1.4.3 ~~... the final amount is 1644 distance~~ 410/15 350 x 60 = 21,000

1.4.4 168100 the actual answer was 410 and I convert it.

1.4.5. 21497 / 462,12 1009 the is the increasing mark. 3

*Figure 5.21*

Question 1.4.1 is a two-part question. For question 1.4.1(a), in her copy of the CTA she measured the distance from Durban to Kruger National Park to be 40. Then she had to measure the scale given. The scale is 25mm: 400km.

To estimate the distance she had to divide 40mm by 25mm and then multiply the result with 400. As a result her calculation should have been $\frac{40}{25} \times 400\text{km} = 640\text{km}$.

Cleo showed no working details, so it is not clear as to how she obtained the 16. Also in her solution she wrote $40 \times 16 = 640$. There is no unit of measure for 40 or 16 or 640.

Her answer to 1.4.1 (b) was "it because I drew a straight line". This statement does not provide an indication that Cleo had an understanding of why the answer was estimation. The answer is estimation because the location of the school is not on the map and one has to assume the closest area of the school to be the location of the school and therefore the location of the school to Kruger National Park, the distance will be estimation. Cleo did not have an understanding of the question. However she knew that the question required two reasons and therefore she provided two reasons irrespective of whether it was appropriate or not. Stating, "the map is also showing" is not a reason for the answer being estimation.

For question 1.4.2 she states, "The answer can change because the distance can also change". This answer is incorrect. Cleo had no idea that the reduced map would still yield the same ratio as the one in 1.4.1.

For 1.4.3 she wrote the correct answer. However the teacher did not acknowledge this response. Cleo wrote $350 \times 60 = 21\ 000$. The numbers 350 and 60 are without units of measure. However she arrived at the correct answer. Since the response was not acknowledged, Cleo did not receive any marks. This once again shows an inconsistency with the marking.

For question 1.4.4, learners required the answer they obtained in 1.4.3. Cleo extracted the numbers 350 and 60 from 1.4.3. She proceeded to add these two numbers, which resulted in 410. Cleo then squared 410. When 410 was squared a value of 168100 was obtained. It is evident that Cleo was struggling to make sense of question 1.4.4. She looked at 1.4.3 and extracted two numbers. She focused on the numbers, irrespective of whether it was the correct thing to do. In the second part of 1.4.4 she extracted the two numbers from the previous question, proceeded with a few calculations and then answered the question by stating that 410 is the actual answer and she converted it to 168100.

For question 1.4.5 Cleo responded to this question with 21497/462, 121009 as a response to percentage increase. The numbers 21497, 462 and 121009 do not appear in question 1.4.5. The number 21497, possibly came from the number 2 149 700. However it seems that because she could not make sense of the question, she provided values that would show some 'calculation'. It will be later revealed in this chapter in the description of the fifth day of classroom observation that Cleo was possibly influenced by the teacher's explanation of this activity.

*Activity 2.1*

The question and memorandum for this activity is presented in Sihle's case.

This is Cleo's response to activity 2.1

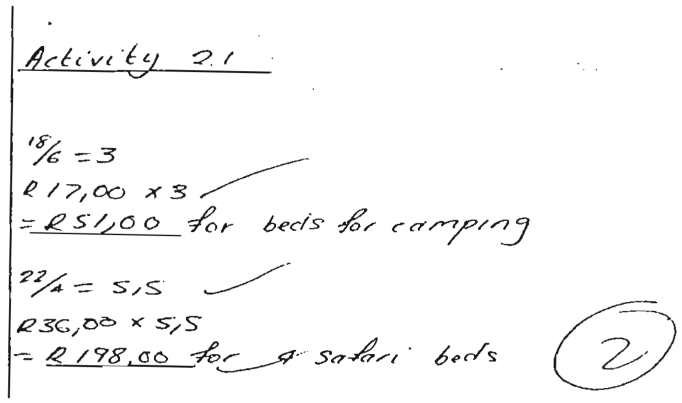



***Figure 5.22***

In this activity, Cleo was certain that 18 boys and 22 girls needed accommodation. She was also aware that the boys would be accommodated in camping units because she extracts 17 from the camping column and used that to arrive at a cost for accommodating the boys. She also extracted 6 indicating that she was aware that the camp sleeps 6 people. She divided the 18 by 6 and arrived at an answer of 3. She correctly calculated that the boys required 3 camping tents. She then proceeded to multiply the 3 with R17 implying that the cost of one camping tent was R17 and 3 would cost R51.

For the girls' accommodation, Cleo ignored the fact that safari tents appeared in two rows. She used the information on safari tents from the second row. For this calculation she divided 22 with 4 and arrived at a decimal value of 5, 5. From this it was clear that Cleo did not make sense of her calculation. If she did, she would have realised that one cannot pay for 0, 5 of a safari tent or in reality 0, 5 of a tent does not exist. She proceeded to multiply the 5, 5 with R36, which she extracted from the second row safari tents and arrived at a value of R198, 00. Cleo extracted R17, 00 and R36, 00 from the column that stated 'tariffs for an additional child'. This shows that Cleo did not have an understanding that the boys and girls in this activity should be regarded as adults and not children. Furthermore Cleo's response revealed that she had no idea what was 'base occupancy'. This is clear from her calculation. By dividing 18 by 6, she is implying that 6 people can be accommodated in a camping tent. She failed to realise that although 6 people could be accommodated in the camping tent, there are standard rates for 2 people and the remaining 4 would have to pay additional costs. Cleo also used the R17 to imply that it cost R17, 00 to use one camping tent. The R17, 00 is "tariffs for an additional child".

Cleo extracted numbers that made sense to her and decided that it would cost R51, 00 for beds for camping. For the accommodation for girls she chose the 4-bed option over the 2-bed option. She also regarded both the safari tent columns as providing one set of information. She used the 4 from the second safari tent while she multiplied the answer with R36, 00 that appeared in the first safari tent. Her answer to this part of the activity was R198, 00 for 4 safari beds. This response is now implying that 4 beds cost R198, 00 and not 4 safari tents. From Cleo's calculation it is possible that she extracted numbers like 4 and 36 because they made sense to her. Cleo also showed that she experienced problems in interpreting the table.

*Activity 2.2.1*

The question and memorandum for this activity is presented in Sihle's case.
This is Cleo's response to activity 2.2.1. Cleo incorrectly labels it as activity 2.1

Activity 2.1.

| Unity type | Tariffs 2004/5 | 2005/6 | Rate | Check | rounding |
|---|---|---|---|---|---|
| | | | | | – |
| Camping | 100, 00 | 105, 00 | $\frac{105}{100}$ = 1, 05 | 1.05 x 100 | 1:05 |
| Safiri tent-Communal f- | 230, 00 | 240, 00 | $\frac{240}{230}$ = 1, 04 | 1.04 x 230 | 239.2 |
| Bungalow CK | 460, 00 | 480, 00 | $\frac{480}{460}$ = 1.04 | 1.04 x 460 | 478.4 |
| Bungalow K | 495, 00 | 515, 00 | $\frac{515}{495}$ = 1.04 | 1.04 x 495 | 514.8 |
| luxury Bungalow | 770, 00 | 800, 00 | $\frac{800}{770}$ = 1.03 | 1.03 x 770 | 793.1 |
| luxury riversid Bungalow | 885, 00 | 920, 00 | $\frac{920}{885}$ = 1.03 | 1.03 x 885 | 911.55 |

(3)

***Figure 5.23***

Cleo's answer, as well as Thabani's and Sihle's are identical to the one in the memorandum.

*Activity 2.3*

The following are both the question and memorandum to this activity.

2.3.1 Use the information on page 8 to find the speed limit on tar roads inside the Park. Use this speed limit to determine at what estimated time the group might have reached Lower Sabie if they had left Skukuza when the gates opened. Give the answer to the nearest minute.

2.3.2 The experienced driver of the bus said that the average speed travelling through the Park is 20 km per hour.

a) Give two possible reasons why this speed is much slower than the speed limit.

b) Travelling at an average speed of 20 km/h, determine the time when the tour group reached Lower Sabie Rest Camp.

2.3.3 The bus left Lower Sable at 9:30 and reached Satara Rest Camp at 16:00. What was the average speed on this part of the journey?

2.3.4 On day 3 the tour group left Satara at 6:00 and travelled to Phalaborwa Gate via Letaba Rest Camp at an average speed of 20 km/h. If they exited the Park at Phalaborwa Gate at 12:30 how long could they have stayed in Letaba Rest Camp?

*Figure 5.24*

| Act no | Possible answers | Mark allocation | | Marks | |
|---|---|---|---|---|---|
| 2.3.1 | Speed limit 50 km/h<br>Gates open: 06:00<br>Distance from Skukuza to Lower Sabie: 46 km<br>Travel time at 50 km/h: $\frac{46}{50} \times 60 = 55$ minutes<br>Time of arrival: 06:55 | Speed limit correct<br>Distance correct<br>Calculating travel time correctly<br>Correct arrival time | 1 mark<br>1 mark<br><br>2 marks<br>1 mark | 5 | |
| 2.3.2 a) | Any two appropriate reasons relating the purpose of driving through the KNP with variance in speed | One mark for each reason | 2 marks | 2 | |
| 2.3.2 b) | Travel time at 20 km/h:<br>$\frac{46}{20} \times 60 = 138$ min = 2 hours and 18 min<br>OR 2,3 hours<br>Time of arrival: 08:18 | Correct rate<br>Correct travel time<br>Correct arrival time | 1 mark<br>1 mark<br>1 mark | 3 | |
| 2.3.3 | Distance from Lower Sabie to Satara: 93 km<br>Duration of trip from Lower Sabie to Satara: 6,5 hours<br>Average speed: $\frac{93km}{6,5h} = 14,3km/h$ | Distance correct<br>Duration of trip correct<br>Average speed correct<br>Unit correct | 1 mark<br>1 mark<br>1 mark<br>1 mark | 4 | |
| 2.3.4 | Distance from Satara to Phalaborwa gate 119km<br>Time spent on road:<br>$\frac{119}{20} \times 60 = 357$ min $\approx 6 hours$<br>If they had left at 06:00 from Satara, they could have spent 33 minutes at Letaba | Distance correct<br>Time spent on road correct<br>Time spent in Letaba | 1 mark<br><br>2 marks<br>1 mark | 4 | $\frac{18}{2}$<br>9 |

*Figure 5.25*

The following is Cleo's response to activity 2.3

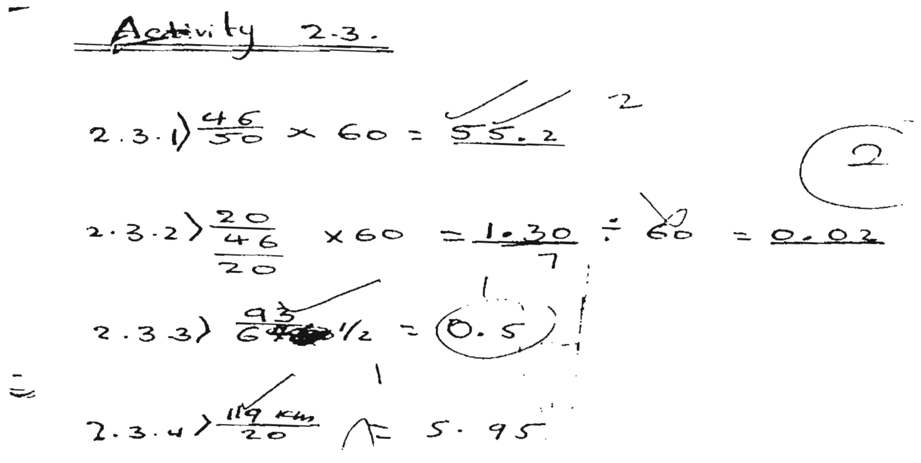



*Figure 5.26*

For question 2.3.1 Cleo correctly calculated the travel time to be 55, 2.
Cleo did not state 46 was the distance from Skukuza to Lower Sabie and did not state that 50 was the speed limit on tar roads. However these two values appear in her calculations. Therefore it is difficult to ascertain how she obtained the correct answer.

For question 2.3.2(a) there is no answer.

For question 2.3.2(b) Cleo provided a very unusual solution. 20 was divided by 46 and divided again by 20. Then the result was multiplied by 60, which resulted in the value of 1.30, which was divided by 60 to provide a solution of 0.02. From this response it is evident that Cleo had picked up figures randomly and performed operations, which made no sense. This seems to have been influenced by the teacher's explanation, which is presented in this chapter in the description of the fourth day of classroom observations.

For question 2.3.3 she had the correct value of 93 and 6½. However her answer to the division of 93 by 6½ was 0.5. Once again it is not clear how she arrived at the answer of 0.5. Cleo performed some operations to lead to an answer she could write. That she arrived at the correct figures of 93 and 6½ but was unable to do the division correctly could indicate that she copied these values from someone.

For question 2.3.4 Cleo's calculation is correct.

From Cleo's responses it is indicative that she struggled at times to makes sense of what was required. She extracted numbers and provided calculations that sometimes made no sense. In question 1.3.1 she provided sketches that did not refer to any unit of measure. In activity 2.1 she was confused. She extracted numbers from the table and proceeded to calculate either the number of beds required or accommodation tents. In activity 2.3 her responses are inconsistent. In activity 1.4 she provided answers for the open questions. However in activity 2.3 she chose not respond to the open question. The teacher did not acknowledge a correct response that also shows inconsistency on the part of the teacher.

There are two other examples of inconsistencies, on the part of the teacher, revealed from the analysis of Cleo's work. Cleo's activity 1.2 was left unmarked.

A second learner produced the following response for activity 2.1

Activity 2,1

$18/6 = 3$

R 17,00 x 3

= R 51,00 for beds for beds for camping

$22/4 = 5,5$

R 36,00 x 5,5

R 198,00 for 4 safari beds

***Figure 5.27***

This response is identical to Cleo's response. However Cleo received 2 marks for the activity while this learner's response was marked wrong.

*Cleo's perception of the CTA*

The interview with Cleo provided an insight into her perception of the CTA. To highlight certain points of Cleo's perception, parts of the interview are presented verbatim.

*Researcher*: Ok. But the CTA is based on class work. You did a certain amount of work in Grade 9 and now you got the CTA, which is based on grade 9 work. What can you say about the CTA in comparison to your class work?
*Cleo:* No. The class work its not hard as the CTA. The CTA is hard.
*Researcher*: Why would you say the CTA is hard?
*Cleo:* Sometimes you get things you didn't expect.

Cleo and I continued with the interview. She spoke about activity 2.3.

*Researcher*: Tell me more about this activity.
*Cleo:* Ya. It's different from class work. But the CTA its like complicated to what we doing in class.
*Researcher*: Why or what makes it complicated.
*Cleo:* Cos mam. It was the first time we where doing the CTA. Ya. We didn't didn't expect such things like this to the CTA. I think we where like expecting maybe it's gonna be like maths only, not about distance and the speed in words. Ya. Not like they going to test us on Kruger National Park.

Cleo and I continued with our conversation and I asked the question.

*Researcher*: 'Cleo have you been on a holiday?'
*Cleo:* no mam.
*Researcher*: Your school holidays are a type of holiday.
*Cleo:* Ya. But it's not a holiday.
*Researcher*: Why not.
*Cleo:* Cos mam I stay at home.
*Researcher*: Don't you go to a relative's home or stay with your friends.
*Cleo:* no mam. We stay at home.

After a discussion on holidays our conversation continued around tasks in the CTA. Cleo continued and then I picked on something that she said. She said she preferred only maths.

*Researcher*: When you say maths only. What do you mean by maths only?
*Cleo:* Like mam. I think we are going to maybe find or maybe solve for x, or equations. Ya. We didn't expect maybe going to test us on how do we know to calculate the speed, the time. And the big fives.

Cleo and I continued with the interview. Cleo stated, "Put something that will that includes maths". I wanted her to elaborate on this statement.

*Researcher*: Ok. Can you give me an example of an activity that was given to you and you had to look for the maths in it.
*Cleo:* Yes. It is ya activity 2.3. We had to calculate what time if you were in the gates at Skukuza, ya, what time we gonna be there in the park. Maybe they say you

were travelling like 20kms and if the road maybe it's long. What time do you think you gonna get there to the Skukuza mountain or Lower Sabie. And then we had to calculate that.

*Researcher*: So how different is that from maths.

*Cleo:* It's because, mam, we had to like, we had to read the passage and then we had to answer and then you have to calculate. Calculate the distance.

*Researcher*: You had to calculate. That is maths. What made it different?

*Cleo:* What's this? The lines. I mean not the lines, the passage.

*Researcher*: Passage. How would you describe a passage?

*Cleo:* Because mam in maths we like expecting things like you gonna get sums, and then they gonna say calculate the distance of this. And then here we get we had to calculate from Skukuza. You get to what's this. Write the time and you have to keep in mind Skukuza and all those things. In maths we like they say, there's this ok right fine. There's solve for x ok. It's like calculate this to get this. But here we have like ok let's Lower Sabie. Ok let me give you Lower Sabie. They say calculate the distance. Why don't they just say ok here there is 20km ok calculate here and here? Like don't say, don't give us the passage. The passage. I mean the words ya. And just give us the equations only.

Cleo continued in the same vein and said that maybe if the CTA were easier it would be better. I picked up on this statement and posed the following question.

*Researcher*: Ok. How would you make it easier? I come up to you and say, Cleo I need to set the CTA for the grade 9's, I need your help. How would you help me set the CTA?

*Cleo:* Mam I would put things the grade 9's are doing. Not things that are gonna be hard for grade 9's. Not passages and words. Cos in grade 9's we as children we like something that we know and we understand. But if they give us something that is complicated its hard for us.

*In summary:* Cleo clearly stated that she didn't expect to get tested on the Kruger National Park. She preferred equations and expected the CTA to have "sums". This shows that Cleo did not recognise the CTA activities as being relevant to what they did in Grade 9 mathematics. She was unable to make links between the activities arising from the CTA and the mathematics that she had studied in grade 9. The activities in the form of "passages" reveal Cleo's distress being faced with activities that she did not understand.

## 5.2 PRESENTATION OF CLASSROOM OBSERVATIONS

The observation is based on video recordings of the teacher and learners engaging in the CTA. The observation was planned for 5 days but was done over four days because the teacher was absent on the second day. In the description that follows I have added some of my personal comments, which is in line with my role as participant observer.

From Monday to Thursday the class periods are 55 minutes. On Friday the class periods are shortened to 45 minutes to accommodate an extended lunch break for sporting activities.

### 5.2.1 <u>Day One</u>

It was Monday 17th October 2005. The learners were informed in the first period that the mathematics lesson would take place at another venue. The new venue was at the opposite end of the school. In the meantime the video had been set up and awaiting the arrival of both learners and teacher. Learners took about 5 minutes to reach the new venue. The teacher arrived 2 minutes after the learners. The teacher had copies of the CTA's for the learners. This left us with a lesson of 48 minutes. As soon as the teacher arrived, she called the class to order, greeted them and informed learners that she had copies of the CTA for each and every learner. The teacher indicated to a learner to hand out the CTA's. Immediately the teacher said "let's open to your first page. Right, let's discuss what this is all about". The teacher did not discuss the purpose of the CTA and did not give the learners the time to orientate themselves with the CTA.

The teacher then said "let's look at your task 1". The learners complied and began flipping pages. The teacher was oblivious to the fact that the learners' were enquiring from one another "where is task 1?" The teacher read out what learners would be assessed on in this task. After reading that, she also read the statement "South African National Parks are spread all over the country as shown on this map". The teachers enquired if the learners had any idea how many national parks were in South Africa. She cued them to look at the map. The learners answered 20.

The teacher then told the learners that they would then proceed with activity 1.1. While reading the question to the learners she realised that the activity had no marks. So she informed the learners that although the activity had no marks, it had to be completed. Then she told the learners that they were going to have a general discussion. She then read from the CTA for activity 1.1. She posed questions and provided the answers herself. Sometimes she acknowledged a learners' response but continued to do most of the 'talking'. The teacher walked around the learners at the front and continued to read from the CTA. In about 10 minutes, activity 1.1 was completed with no general discussion.

The teacher spoke loudly and did all the talking. She then told learners in conclusion to activity 1.1, "Ok that is activity 1.1. which you would write out. Right I'm not giving you marks but if you clever enough, you would have had your book out in front of you and just put down, jot down a few answers there". The learners received the CTA and immediately began working with it. They received no direction from the teacher were questions should be answered. Since the CTA was both a question and answer booklet, the teacher did not instruct learners as to where they should record responses but at the end of activity 1.1, she implied that if learners' were smart they would have recorded responses as she spoke.

She then moved onto activity 1.2. The teacher pointed out to learners that the activity was a pair activity while activity 1.1 was a group activity. At the beginning of activity 1.1 the teacher did not inform learners that activity 1.1 was a group activity. She proceeded with a general discussion and chose to inform learners that activity 1.2 was a paired activity. The reason for this was that she immediately told learners to discuss the activity with a learner next to them or to pair off with someone. She told learners they would be given two minutes to discuss the activity. As soon as learners paired off, she did all the discussion of the activity by walking around the class and reading from the CTA. She indicated to learners that an example was given and, to answer the question on scales, they needed to follow the example. Then she told learners that the first answer should be labelled 1.2.1 and then realised that in between the examples of the activity the questions were numbered from 1.2.1 to 1.2.4.

The teacher continued to walk around the class to check that learners were engaging with activity 1.2. While walking around she realised that learners were confused and were answering the shaded portion of the activity. It was then that she informed learners that the shaded portion were examples that should be used to answer follow on questions. For question 1.2.1 she asked the learners for their answers. One learner responded with 280 km. She went to the learner and checked the answer. She was happy with that response and then indicated to all the learners that the answer for question 1.2.1 was 280 km.

The teacher followed the same routine for question 1.2.2. The teacher then moved on to question 1.2.3. She indicated to learners that they needed to measure the line. A learner gave her an answer. Perhaps the teacher knew the capabilities of the learner who gave her an answer for the measurement of the line because the teacher readily accepted the value of the line to be 45 mm. Her reply to another learner was "you must get 45". Then she told the learner, "Ok use mm. Right, cos your mm is smaller and you don't have exact cm". From the discussion with the learner, it was evident that the learner was not sure which line to measure because she told the learner "that you are not supposed to measure the line in the grey block, you have to measure in the white block". After the teacher pointed out to the learner, the line to measure, the very same learner replied that the value of the line was 45. To which the teacher told the class "45. Did you get it? 45. That's right. So you should have 45".

However from a closer inspection of the line, the line could be three possible values. This was revealed in chapter 4 under activity 1.2. This was also revealed in Sihle's response to this question. Sihle obtained a value of 48 mm, which was one of the possibilities. Once the value of the line was established the teacher then enquired about what number must be used to divide 45. From the example, 'y' is the measurement of the line and 'x' is the measurement of the scale. However the learners told the teacher that 45 must be divided by 20 and the teacher wanted to know 'why 20'? A learner responded by saying that the example given used 20. The teacher then replied that that was correct. Then the teacher asked for the answer to "45 divided by 20". A learner responded with an answer of 2, 5 km. The teacher replied, "you are getting 25 km". Another learner responded with 2, 25. The teacher ignored the answer of 2, 25 and then said, "What do they mean by try one more scale?" She ignored the learners and posed another question. The answer of 2, 25 or 2, 5 is incorrect because learners needed to measure the scale provided in question 1.2.3. That measurement is 15mm. Therefore the answer for 1.2.3, if the learners used 45 mm, should have been 60 km. This is obtained by dividing 45 with 15 (and not 20 as agreed by the teacher) and then multiplying that value with 20 km to arrive at an answer of 60 km.

The teacher then gave an explanation on scale to learners. The teacher drew the learners' attention to 1mm is 1km, etc to indicate that those are forms of scale. She then told learners to choose any scale. However they would still have to arrive at an answer of 40km irrespective of the scale used. A learner used 1mm is 2km. The teacher told the class that he used 1 is to 2mm. She had a quick discussion with the learner and agreed with the learner that the scale of 1mm is to 2km is correct. She looked away from the learner and said "so his scale was 1 is to 2". That statement was not correct because 1 is to 2 was not clearly stating the unit. She then encouraged learners to try different scales and offered an example that they should try. The example she gave them was 1 is to 200 000. She did not attach any units of measure to the scale. She asked one pupil to try out the scale and in the same vein enquired what the answer was. The learner responded that he obtained an answer of 40km. The teacher, without checking, agreed that the answer was correct.

However if the scale is applied then the answer is not 40km. Since no units of measure was given, learners could have used 1mm is to 200 000mm or 1cm is to 200 000cm. If the scale was 1mm is to 200 000mm then this implies that 1mm is equivalent to 0,2km on the ground. Therefore 20mm will be equivalent to 4km and not 40km. Even if 1cm is to 200 000cm is used, it does not result in 40km. The teacher was happy with the learner's response. As previously stated, the teacher seemed to be aware of certain learners' capabilities because she readily accepted that the scale given obtained an answer of 40km and said "that is activity 1.2 let us now go to activity 1.3".

For activity 1.3 she instructed a pupil to read out 1.3.1. The teacher then read out 1.3.2. She then told the class that they needed to convert from one unit to another and that they needed to complete table 2. She told learners that they would still be working in pairs so they needed to have a quick discussion about conversions. In the same breath she said that they needed to draw a table. By saying they needed a table meant she was going back to question 1.3.1. She told the class that she was going to give those headings and they had to take them down. The teacher provided the headings by calling out the headings that were required for this activity. She said, "Right these are the headings. Distance under column one, area under column two and volume in the next column". She then repeated, "Take the headings down".

She provided the class with an example and told them the reason for the example was "so you know what's happening". She provided examples for distance, area and volume. She took mm and then said that for distance, one would use mm. When one explained area then mm becomes mm squared and for volume it becomes mm cubed. The same would apply to any other unit of measure used. The teacher's interpretation of question 1.3.1 was that the question required a table with three headings and the unit of measure should be described as a linear, as a square and a cube. It is likely that this explanation is what led Sihle to produce a second table for which he was not allocated any marks.

The teacher also explained to learners that when a desk was measured, depending on its size, mm, cm or metres could be used and she continued with a few examples on the appropriate units of measure. As soon as that was said the teacher then moved on to question 1.3.2, which was table 2. She told learners that with all the examples she had given them, they were now in a position to give her answers.

The teacher then posed a question. She asked learners if anyone knew how to convert from mm to cm. without waiting for a response she said "We divide by 10". After that she instructed them to write that down. She then repeated, "From mm to cm you divide by 10". Immediately after that she posed the question on how to convert from cm to metres. A learner responded with "you multiply by 10". The teacher then said "I am talking about cm to metres". Another pupil enquired if metres were larger. The teacher responded by saying that metres are larger than mm or cm.

The teacher then said that if centimetres were converted to metres the amount arrived at would be smaller. She continued to say that if the learners wanted to convert 1000 cm to metres they would have to divide. And then she provided the value that was needed to convert from cm to metres. The manner she used to provide the number was as if she was making an important revelation. Because in a more subdued tone she said that if the learners wanted to convert 1000cm to metres they would have to divide that number by ten thousand. The learners were surprised and repeated "ten thousand". To prove that she was correct she took 2m squared and said that to convert that to cm they had to multiply by 10 000. Therefore 2m squared was equivalent to 20 000 square cm. Then the teachers reiterated her point by saying that to convert from mm to cm they should divide by 10 and multiply to go backwards and then said that to convert from cm to m they should divide by 10000 and multiply by 10000 to convert m to cm. She then told learners that the ruler helped with conversions. The siren sounded and the teacher said that they would continue with the activities the following day.

*In summary:* During the entire lesson the learners were listening and looking at certain activities. Some learners were having their own conversations while some learners were trying to attempt the activities. When a learner provided an explanation, the teacher either ignored the learner or acknowledged the learner by saying "yes" but continued with her own explanation. In this 48minute lesson the teacher discussed and completed activities 1.1, 1.2 and activity 1.3 question 1.3.1.

5.2.2 Day Two

The teacher was absent.

5.2.3 Day Three

The teacher started the lesson by saying that as she was absent the day before; they needed to look at activity 1.4. She drew the learners' attention to the block above the activity. She told them that the block stated 'individual'. It meant that that activity had to be done on their own. She then got angry and enquired from the class if they had done any work on the previous day. She also told them that they should have completed activity 1.4. on there own the day before. The teacher then told the learners that the activity should be completed at home and that she would be checking on it the next day. Immediately after that she moved on to task 2 on page 7.

The teacher then began the lesson. Once again she read from page 7 and told learners that they were going to be working on task 2. She read out what the learners would be assessed on and noted that task 2 was worth 27 marks. She reminded the class about the bar graph that was done during the year and told them that it was very important and "that was the reason for doing the bar graph". The teacher continued to talk and ignored learners' responses. She then read the information about 'Accommodation in the Kruger National Park' on page 7 (see annexure A) without stopping at any point to enquire whether the learners understood her monologue. It was as if she was conducting a conversation with herself.

At that point she posed a question to learners. "So how old are you?" A few learners responded by saying "15". She then told them that they would be regarded as "An adult". Immediately after telling learners that they were regarded as adults, she then zoomed in on the statement "All tariffs in South African rand". She questioned the learners with such statements as "Why South African rands?" "Why rands?" "Why not other currencies, why rands?" These learners were mumbling and responded with "We are in South Africa". Then she provided an explanation, by stating that someone who lived in America, while visiting South Africa, would have to change the Dollars to rands. She further explained that that was exchange rate. With a change in tone she reverted back to the CTA.

The teacher continued to read and then wanted an explanation for "Additional person supplement". This teacher did not give the learners an opportunity to answer. She presented a scenario where 5 people were going on holiday and were provided with a family room that catered for 4 people. Then she wanted to know "What happens with the case like this?" One learner responded with "Give you an extra room". The teacher accepted the learner's response with a "yes" and continued, "Yes, this is additional rates when they tell you the cost for one more person". It was evident at this point that the teacher was not listening to the learners. She seemed focused on completing the activities and had her own ideas that she needed to put across to the learners.

The lesson went on with her discussing the festive season and telling learners that prices varied according to seasons and then she told the learners "you have an idea. Surely you go on holidays or little weekends away with the family". At this point the teacher made an assumption about learners' experiences about holidays because she did not pause or enquire about learners' experiences of holidays but instead continued after telling learners that they were aware of holiday experiences.

The teacher then read through Table 3 and told learners that there were different unit types with different costs and interspersed it with questions such as "You understand the difference?" or "Right can you see why for a child is lesser than an adult?" and "you understand?" After a 'discussion' the teacher then told the class that they would have to use the information on pages 7 and 9 to answer activity 2.1. The teacher stressed to learners that it was an individual activity and it had to be completed as homework.

The teacher then moved on to activity 2.2. As she had previously done, she told learners that they were working in groups for the activity and once again read out the whole of question 2.2.1 and then instructed learners to discuss it amongst themselves and said that they should come up with solutions. During the time given to learners for group discussion a group attempted to answer the question. Learners became uneasy and were noisy during the discussion time. After some time the teacher called the class to attention, read out question 2.2.1 again and enquired for a volunteered answer. One learner responded that their group "was not sure what to do" while another learner looked to another learner and asked, "What's tabular?" The teacher wanted to know from the learner what was it that he did not understand. The learner replied that he was confused.

The teacher in a raised tone pointed out to the learner that there was an increase by indicating that R100 increased to R105. Then the teacher stated to the class, in the same tone of voice, that the question required them to investigate the rate. She used the example of R100 and R105 again. She drew a table on the board and said to them that they were going to add more columns to the table. Then she repeated that there was an increase of R5. Then she said, "Investigate the rate". Immediately after that she posed the question, "How many of you understand what is rate of change?" The learners did not respond to the question and the teacher then angrily said, "That is something you should have known, rate of change". Then the teacher posed the question, "Do you know rate of change?" The learners responded with a "no". The teacher replied, "that is why I'm going to show you the rate of change".

It was not clear as to why she got angry with the learners because the teacher then proceeded to provide learners with a table with additional columns and the answers. She explained that one column was for unit type; the second was for the year, the third was also for the year and the fourth was for rate of change. Then she said that the fifth was for checking and the sixth was for rounding off. It was clear that the teacher had the memorandum because she told learners to draw six columns and the headings that she provided could only be found in the memorandum while the instructions to the very same questions did not indicate how many columns were to be added and what the additional columns represented.

Although the teacher provided the solution, step-by-step, she conveniently ignored learners who were repeatedly enquiring for example as to why R478 was rounded off to R480. She continued to maintain a rate of change of 1, 04 or 1, 05. However a closer look at the memorandum for this question indicated that for R478 to be rounded up to R480 the rate of change used was actually 3 decimal places, which the teacher did not pick up. The teacher instead maintained a steady rate and showed them how simple it was to check and round off, as it was the same as the 2005/2006 tariffs. Having completed question 2.2.1 she told learners to complete question 2.2.2 on their own because she needed to discuss another question.

At the beginning of the lesson the teacher instructed the learners to complete question 1.4 on their own, but she then decided that she would like to discuss the very same question. She told learners that she was going to help them with question 1.4. The teacher read out question 1.4.1. Then she told the class to make a dot on the map on page 4, the dot should be on Durban. She then told the class that she had to help them with the activity because they would "Mix it up", and then she added that it was a very difficult activity and that she had to explain it to them thoroughly. The lesson ended and she told the class that she would explain the activity to them on the following day.

*In summary:* The teacher did most of the talking and learner responses seemed to have fallen on deaf ears. The teacher also made an assumption about learners' experiences of holidays. Lastly the teacher provided the solution to question 2.2.1. In 5.1 it was revealed that the instructions to this question were vague yet all three learners in this study had the correct solution to question 2.2.1.

### 5.2.4 <u>Day Four</u>

The teacher immediately started with activity 2.3. She told the class that they needed to use the information on page 8 for that activity and she also told them that since they had their CTA's with them, they should have read through the activity. After reading question 2.3.1 the teacher told the learners that they needed to determine the speed limit. Once that was established, they needed to determine the time the gates opened. The teacher said that in order to determine the time the gates opened they needed to bear in mind which month they were in. Since the CTA was during October, the learners responded with October and the teacher said that that was correct. However according to the information on page 8, the month to be used was July and not October. Therefore the learners used 5:30 as the opening time instead of 6:00.

The learners needed to determine the distance from Lower Sabie to Skukuza. For that the teacher told them to locate Lower Sabie and Skukuza on the map on page 8 and to physically measure it with a ruler. Some learners obtained 20mm, 30mm, 35mm or 40mm. The teacher asked the class if they obtained 35mm. Then she told learners to look at the distance table on page 8 and it had 160. Then she told a learner who got 40mm, that his response was 40mm while the table was showing 160. She then revealed to the class that if 40 had to be converted to kilometres then it would have to be multiplied by 16. It was not clear as to why the teacher needed to know if anyone obtained a measure of 35mm, as she did not use that value again. Also, the conversion of 40mm to kilometres that had to be multiplied by 16, made no sense. While looking at the table the teacher realised that the distance was given. She responded by saying, "The distance I think comes from your table". Not fazed out by what she had just done, she continued by saying to the class that the distance was given and it was not necessary to measure it. This was discussed in chapter 4 under activity 2.3.

The teacher then established the distance to be 46km. She then told the class that because they had all the information for question 2.3.1, she was not going to give them the answer. They needed to calculate it on their own. However she told them that the formula for the calculation of time was "Distance over the speed limit times time". She told the learners that if they did what she had indicated, they would get the answer for 2.3.1. What she did not tell the learners was that by doing so, the time got converted to minutes, which would then have to be added to the opening times to obtain an estimated time of arrival.

The teacher then moved on to question 2.3.2 and told learners that they now had to use the speed limit of 20km/h. She then told the class that in the previous question they had multiplied by 60, which gave the answer in minutes, but now this question required the answer in hours, so they would have to divide 46 by 20 and then divide by 60 to get the answer in hours and that would give them the travelling time for question 2.3.2. This instruction given by the teacher seems to have influenced Cleo's response to this question, which was discussed earlier in this chapter.

The teacher then moved on to question 2.3.3 and she told learners in one sentence that the distance was 93, the time was 6 and a half hours and the formula for average speed was distance over time. They needed to use that information and then they would have the answer for 2.3.3. In question 2.3.4 she told learners that the question needed a few calculations. She explained that if they got the travel time, then the time spent at the rest camp would be established by subtracting the travel time from the time of arrival. She told learners that the distance was 119km and the rest could be completed at home as they needed to complete activity 2.4.

The teacher reminded the class that a few weeks ago they had done a frequency table and that activity 2.4 was similar. She instructed them to work in groups to complete the activity. The teacher walked around. The siren sounded for the end of the lesson. She informed the class that she would be collecting all their work the next day and that they needed to staple loose pages and place the pages into their CTA's because the CTA was also to be collected as it was an answer booklet as well.

*In summary:* The teacher was not aware of the opening time that was required for activity 2.3. Secondly the teacher misunderstood the distance required. She instructed learners to measure the distance from the map provided on page 8. She hurriedly explained activity 2.3.

### 5.2.5 Day Five

Day 5 was the last day scheduled for the implementation of the CTA. The lesson was in the first period. The teacher was late. As soon as she walked in, she called the class to attention. She immediately began the lesson with a discussion of activity 2.4. She spent the greater half of the lesson discussing the poaching of animals and why they needed to be protected. Then she told the class that they needed to round off all their activities because this was the last day that they would be engaging with the CTA. The learners were disgruntled.

The teacher reminded the learners that there were many tasks in the CTA and that they were fortunate to have done only two of the tasks. She drew the learners' attention to the instruction that the CTA should have been done over 5 periods and that they were lucky to have done half of the CTA over 5 periods. Earlier in chapter 4, I raised the point concerning the instruction about the allocated time for the CTA. The teacher used the very same instruction to reveal to the learners that they were fortunate to have done half the CTA over a five-hour period.

The teacher then revealed to the class that she was aware that some questions were unanswered. She went back to question 1.3.2 and gave the learners a few conversions. She then moved on to activity 1.4 and she reminded the learners that they had started the activity the previous day. She then went on to question 1.4.2. She explained that question 1.4.3 was a calculation of area. Then she told learners that they needed the answer of 1.4.3 for question 1.4.4 and that they needed the answer from 1.4.4 for 1.4.5. This was not true because 1.4.5 was a question entirely on its own. In Cleo's response to this activity she used her answers from previous questions to answer question 1.4.5. It is clear that Cleo was influenced by the teacher's explanation to this activity. Question 1.4.5 needed a calculation of percentage increase, so the teacher spent the latter part of the lesson explaining the calculation of percentage. She told learners that they should not have a problem with task 2 because she knew that she had explained it "very well" to them the previous day. The lesson ended and she reminded the class that she would be collecting all their work in the course of the day.

*In summary:* When I decided to observe the video recordings, my intention was to look at learners engaging in the CTA's. I wanted to observe learners' body language and their interaction with their peers. I was present for every class lesson. I observed the learners sometimes having their own conversations. All the learners who participated in the study spoke and wrote English as a second language. Therefore I was not surprised when I sat near a group of learners who spoke in Zulu to each other and responded in English to the teacher. I felt my observation would yield data on other learners. However on viewing the videos, I could not help but focus on the teacher.

The teacher was loud and sometimes seemed to ignore the learners. It is quite evident that the teacher had not prepared herself for the CTA. She came into class and continually read from the CTA. She made assumptions that the learners could read and understand without her explaining. She made assumptions that the learners went on holidays and that they would have an idea on how to answer activity 2.1. Whenever an activity stated 'individual work', the teacher told learners that it should be done as homework. The teacher's approach and under preparedness were some of the contributing factors to how learners experienced the CTA in this class.

## 5.3 CHAPTER SUMMARY

In this chapter I presented the case studies of the 3 participant learners as well as a description of four days of classroom observations.

# CHAPTER 6

# FINDINGS

Chapter Four was devoted to an analysis of the Common Tasks for Assessment in Mathematical Literacy, Mathematics and Mathematical Sciences for 2005. In chapter five I presented the data obtained from the written responses of participants to the CTA in MMLMS, interviews with participants and classroom observations, with the intention of providing a comprehensive picture of the experiences of our three learners with respect to the CTA. This chapter is now devoted to providing answers to the research questions and to make a connection between the findings in this study, the literature reviewed in Chapter Two and my research questions.

## 6.1 ANSWERS TO RESEARCH QUESTION 1: HOW DID THE TEACHER MEDIATE THE CTA?

The analysis of the data revealed that the teacher sometimes: did not prepare beforehand; provided incorrect information to the learners; accepted learners' incorrect responses; provided answers to her learners as they appeared in the memorandum and marked learners' work in an inconsistent manner. These findings were revealed in Chapter Five under the description of the lesson observations. Because of the large amount of supporting evidence to back my claims, I have decided to annotate these categories in a table. This is done so as to facilitate the reading and to take less space. So below is a table with two columns, the first of which are my claims about the teacher's responses. The second column provides the evidentiary basis for my claims in a summarised form.

Table 6.1 Claims about the teacher supported with evidence

| Claim | Supporting Evidence |
|---|---|
| The teacher did not prepare beforehand. | 1. The teacher continually read from the CTA.<br>2. While engaging with the CTA, she realised that activity 1.1 had no marks.<br>3. Told learners to number activity 1.2 as 1.2.1 etc and then noticed the activity was already numbered.<br>4. For question 1.2.3 the line measure varied. The teacher was not aware of that because she accepted a learner's response and did not provide further information.<br>5. For question 2.3.2 she told learners to measure the distance on the map on page 8 and during the discussion, realised a distance table was provided.<br>6. On day 3 she told learners to complete activity 1.4 as homework but at the end of the lesson discussed activity 1.4 and completes question 1.4.1 with them. |
| The teacher often provided incorrect information. | 1. For question 1.3.2 she told learners that in order to convert 1000cm to metres they needed to divide by 10 000.<br>2. Question 1.4.5 was a question to be answered on its own but told learners that they needed 1.4.4 to answer 1.4.5.<br>3. For question 2.2.1, she was not aware that the numbers were rounded off because the rate used varied from two to four decimal places but replied to a learner "478 is an odd number so it's rounded off to 480".<br>4. For question 2.3.1, the opening time was for the month of July but conveyed to learners that it was October, the month in which they were engaging with the CTA.<br>5. For question 2.3.2 told learners that in order to convert distance divided by speed into hours, they should divide by 60. Distance was in kilometres and speed was in kilometres per hour, so the answer obtained would have been in hours already.<br>6. For 2.3.1 told learners that if "40 mm had to be converted to kilometres then it would have to be multiplied by 16". A comment that was irrelevant to the task. |
| The teacher provided answers from the memorandum. | For question 2.2.1 the teacher provided the learners with the solution. This was evident in Sihle, Thabani and Cleo's responses. This was also evident from the observation because the teacher provided headings and columns that were not given in the instructions provided for this question. |
| The teacher accepted learners' incorrect responses. | 1. For question 1.2.3 a learner stated that 'x', the measurement to be used in the scale conversion, was 20, which she accepted, however 'x' was equal to 15 mm.<br>2. The scale of 1: 200 000 does not convert 20mm to 40km but accepted a learner's response that it converted to 40 km.<br>3. For question 1.2.3 a learner responded with an answer of 2, 25 and the teacher accepted the response.<br>4. For the question "What is additional rates?" a learner responded with "give you an extra room". The teacher responded with a "yes". |
| The teacher's marking was inconsistent. | 1. Haphazardly placed ticks which were evident in Sihle's response to activity 1.2.<br>2. For question 1.3.1 Sihle received 3 marks for a table that |

| | |
|---|---|
| | differed from the memorandum and no mark for a table that fulfilled some requirements.<br>3. For activity 2.1 Sihle provided a table as his solution and critical values such as 18 boys and 22 girls were left out yet he received 2 marks.<br>4. Thabani demonstrated a deeper understanding to question 1.3.1 and only received 2 marks.<br>5. Thabani extracted critical information for activity 2.1.but his response was marked as incorrect.<br>6. A learner's response to activity 1.2 was not marked.<br>7. Cleo's response to question 1.3.1 made no sense yet she received 4 marks for this question instead of 1 mark.<br>8. Cleo's response to question 1.4.3 was not marked.<br>9. For activity 2.1, Cleo received 2 marks for her response but another learner with the identical response received no marks. |

Prestage & Perks (2001) stated that problems that are set in context usually pose the biggest challenges to educators. In this CTA setting, the role of the teacher was made more crucial because of the stipulation by the Department of Education that the teacher was allowed to intervene in order to "help learners succeed" (DoE, 2002, p.12). Unpacking the CTA became the problem of the teacher, who had to unpack the problems in the different contexts and to help learners answer the mathematical questions embedded within the context. This is a huge responsibility on the part of the teacher. An interview with Sihle established that he would have preferred more intervention from the teacher.

From the descriptions of the classroom observations, which appeared in Chapter Five, it is evident that the teacher continually read from the CTA. The teacher rarely paused to explain or to enquire from learners about matters pertaining to the different activities. The CTA contained large amounts of textual material. Most of the words were not part of learners' everyday vocabulary, therefore they would have benefited from regular explanations. The teacher needed to provide more guidance to learners on what was expected from each activity. A lack of guidance and assistance was evident from the video observation.

The teacher interventions were often harmful, rather than helping her learners 'to succeed'. For example in Cleo's case, we saw two instances where Cleo seemed to have been directly influenced by the teacher's misguided instructions. Cleo used 350 and 60 from question 1.4.3 as a basis for her calculations in question 1.4.4. This seemed to have been influenced by the teacher's direction that they should "use question 1.4.3 for question 1.4.4

and question 1.4.4 for question 1.4.5". Furthermore in lesson 4, the teacher told learners (incorrectly) that they should divide the result (question 2.3.2) by 60. It is likely that the teacher's instruction led Cleo to divide her answer by 60 for no apparent reason.

The teacher's actions, when she marked inconsistently and accepted incorrect responses, also negatively affected her learners. Although in certain instances when she gave the learners the exact answers appearing in the memorandum, this could be seen as an attempt to help her learners succeed, in line with the CTA requirement. Although the teacher was one of the contributing factors on how the learners experienced the CTA, the teacher cannot be held to be entirely responsible for their poor results. Learners should also take responsibility for their own learning, as this is one of the principles of C2005. Sihle conveys the impression that he is one of those learners who needs constant guidance and assistance. Therefore when left to continue on his own, Sihle is not capable to answer the required work, he blames the teacher. Also the fact that the tasks were set in context also contributed to the poor results.

The Common Tasks for Assessment in Mathematical Literacy, Mathematics and Mathematical Sciences contribute 25% to the final mark a learner obtains in mathematics at the end of grade 9. Since it is an important undertaking, it is imperative that the provincial departments monitor that the CTA is being written by all grade 9 learners and that the marking of the CTA is moderated. In this study, the CTA was not monitored or the marking moderated as indicated by the Government Gazette (DoE, 2003). In my study the teacher did not view the CTA as an important assessment activity and marked the CTA haphazardly, which was evident with red ticks being placed any where on the written response of the learners. This inevitably disadvantaged the learners and is an illustration of Cooper's (1992) statement that "the children, potentially, become the confused victims" between the state and the educational profession (p. 242).

## 6.2 ANSWERS TO RESEARCH QUESTION 2: WHAT ARE THE LEARNERS' PERCEPTIONS OF THE COMMON TASKS FOR ASSESSMENT IN MLMMS?

The analysis of the data revealed that the learners perceived the CTA to be difficult; and different from the assessment they were accustomed to. The learners also expressed the view that they preferred decontextualised assessment tasks as opposed to assessment tasks set within contexts. Again, for ease of reading and space constraints, these categories are tabulated. The categories appear in the first column with supporting evidence cited in the next 3 columns, one for each participant. The evidence consists of direct quotes obtained from interviews with each learner, and found in Chapter 5 under individual cases.

Table 6.2 Learners' perceptions supported with evidence

| Learners' Perceptions | Sihle | Thabani | Cleo |
|---|---|---|---|
| The learners found the CTA to be difficult. | They should not be sending such hard things for pupils. | I was not able to understand what was the questions.<br>But with the CTA it seems like almost all the questions were like difficult. | But if they give us something that is complicated it's hard for us. |
| The learners found the CTA to be different from what they were used to. | We were never given a task like that. They give us like sums for us to calculate. | It was something I have never done before. | Sometimes you get things you didn't expect. Because mam, in maths, we like expecting things like you gonna get sums. I think we are going to maybe find solve for x not passages and words. |
| The learners prefer decontexualised tasks to tasks set within contexts. | They'll only give us distance not distance with words | It would have made a big difference if the CTA was written in sums. The words the language makes it more complicated. | Don't give us the passage. The passage. I mean words ya. And just give us the equations only. |

In addition to the learners' common perceptions of the CTA, both Sihle and Thabani voiced concerns, which do not fit directly into the 3 categories. The specialised language of the CTA was difficult for Sihle. His response to the question "What does tariffs for accommodation mean?" was "no mam I don't understand it. Cos mam since I've entered school, I've never come across a heading like that". Thabani on the other hand expressed his experience as "I was under a lot of pressure. A lack of understanding just makes you feel stupid about yourself". This was from a learner who is regarded as an excellent mathematics student.

These learners are capable mathematics learners and are comfortable with mathematics in its esoteric form and designing the CTA, which relied heavily on language proficiency and based on 'real-life' context, disadvantaged these learners. Poliah (2003) stated that when the tasks for the CTA were designed, certain principles were adhered to. One of the principles was that tasks must be grounded in 'real-life' context and the other was that tasks should be structured so that you (I assume the you refer to the educator) can help students succeed. In this study it was evident that the learners had a problem with tasks being grounded in real-life context.

Sullivan, Zevenbergen and Mousley (2003), stated that the suitability of contexts are complex and multidimensional. The manners in which task contexts are presented have potential to alienate some groups of students. In this study, all three learners are capable mathematics learners. By presenting tasks in context instead of 'sums' as they stated, a degree of alienation was produced, especially for Thabani. Thabani could not accept at times that he was unable to provide solutions to the problems and could not relate to the problems. Sullivan et al (2003) argue that before using contexts, its mathematical suitability, interest and relevance to students, potential motivational impact, and the possibility of negative effects or tendency to exclude some students, need to be considered. The negative effect was evident in this study with the impact it had on Thabani. The interest and relevance of contexts were discussed in the previous paragraph.

Myburgh, Oersen, Poggenpoel and Van Rensburg (2004) stated that due to political changes in South Africa, it is common to find learners from different cultural and language backgrounds in the same classroom and in classes where the language of instruction is different from their mother tongue. The learners in this study are from different cultural and language backgrounds. Schlebusch (2002) argued that learners' language deficiency in English is hidden in everyday conversation and in order to achieve academic success, a more refined command of language is required.

In this study the learners are able to converse in English. However the language of the CTA as Thabani stated, "When it is written in words, I am unable to relate what they are asking me to do", have a negative effect. The learners in this study needed academic language proficiency in order to retrieve important information from the CTA. In addition Boaler (2003) argues that a standardised test "stacks the decks against language learners", because the standardised tests was in a language which was not the learners' first language. This was evidenced in this case study. English was not the first language for all 3 learners in this study, so by setting mathematics tasks within context, disadvantaged them. Cooper & Dunne (2004) stated that testing via "realistically" contextualised items might have unintended consequences especially for the validity of the assessment of working- class children's knowledge and understanding.

## 6.3 ANSWERS TO RESEARCH QUESTION 3: WHAT ARE SOME OF THE LEARNERS' EXPERIENCES WITH RESPECT TO THE CTA, AS REVEALED BY THEIR ACTUAL RESPONSES TO CERTAIN TASKS?

I firstly present a tabulated profile of Sihle, Thabani and Cleo together with the tasks of the three learners that were analysed. I will then present the categories that emerged from the analysis with respect to this research question.

### 6.3.1 Profile of learners

Table 6.3 Brief profile of Sihle, Thabani and Cleo

| | Sihle | Thabani | Cleo |
|---|---|---|---|
| Average of mathematics marks for three controlled tests. | 56% | 93% | 47% |
| CTA mark. | 37% | 50% | 28% |
| Home language. | IsiZulu | IsiXhosa | Isizulu |
| Economic status. | Low income | Low income | Low income |
| Tasks chosen for analysis. | 1.2; 1.31; 2.1; 2.2.1 | 1.3.1; 2.1; 2.2.1 | 1.3.1; 1.4; 2.1; 2.2.1; 2.3 |

### 6.3.2 An analysis of the responses of learners to the selected CTA activities, revealed the following four categories.

*Learners missed 'crucial information' because of the overload of 'context information'.*

The phrase 'crucial information' refers to information without which the task cannot be solved while 'context information' refers to facts or information about the context, which may be disregarded in the solution of the task. (Bansilal & Wallace, 2008).

This was evidenced by Sihle's response to activity 2.1 which had information preceding the task spread across 3 pages. In this activity Sihle did not extract the most crucial information that was required to answer the task. The information he required was 18 boys and 22 girls needed accommodation at a minimum cost. Sihle was not able to extract the crucial information of 18 boys and 22 girls. He also did not extract the fact that the 'minimum cost' was needed. The third critical information that was missed was that a child over 12 was regarded as an adult. Therefore, when calculating the cost of additional persons in a room, learners had to look at the additional cost for an adult and not the additional cost for a child. Both Sihle and Cleo missed this crucial information and used the cost for an additional child instead.

It was also evidenced with the teacher responding to activity 2.3. This activity had information spread across 2 pages. On the top of page 9 the details of an excursion were given. This detail of the excursion contained a vital piece of information. The information was that the excursion took place during the month of July. The opening time of the Kruger National Park during July was the critical information that the learners needed to proceed with further calculations based on that opening time. However the teacher did not extract that crucial information that the opening time was for the month of July. Instead learners used the opening time for the month of October. Since the opening times were different, learners did not get the correct answers and the teacher marked according to the memorandum not realising that the learners used a different opening time.

*The learners' experience of the context of holiday differed from the notion of holiday utilised in the tasks and their experiences did not contribute to an understanding of the specialised language and complexities of the context.*

This was evidenced from interviews with Sihle, Thabani and Cleo. Their experiences of holidays are staying with a relative during the school holidays, visiting a parent during the school holidays or staying at home during the school holidays. Therefore their experiences of holidays were different from the context presented in activity 2.1 in the CTA.

Furthermore, the specialised language such as 'base occupancy', 'additional person supplements' is beyond the experiences of these learners. This was evidenced in Sihle and Cleo's responses. Sihle missed crucial information but manipulated figures from the table. His calculations do not show an understanding of the question's requirement of determining a minimum cost. Cleo identified 18 boys and 22 girls. However by obtaining a decimal value and proceeding to manipulate the decimal value to obtain a result and then making no reference to minimum cost, is an indication that Cleo was not realistic. If she understood the context then she would have realised that one cannot obtain half a bed or half a person.

Thabani on the other hand obtained 18 and 22 and proceeded to divide and then stopped. While Sihle and Cleo proceeded with their 'errors', Thabani chose to stop. His calculations are correct yet show no response towards the question's requirement of minimum cost. Thabani was a high achiever in mathematics, yet could not figure out how to work out the minimum cost. It is likely that Thabani did not understand the implication that the story presented different options and that one could make varied choices, which would result in different costs. His holiday experiences would not have allowed him the necessary insight needed to decide on how to solve the problem.

*The instructions of some tasks were ambiguous in that only the task designer seemed to know what was required and the memorandum was restrictive.*

The instructions provided had varying degrees of readability. In Chapter Four the readability of tasks was discussed. The most preferred level of readability as described by the Flesh Kincaid was readability at grade 8 levels and that level was for first language speakers. The learners in my study are second language speakers so the level of readability was too high.

From the marking memorandum it is evident that the task designer had a specific answer that was being sought. Activity 1.3.1 produced a range of responses. The teacher responded to this activity by stating "direction is expressed in metres, area in square metres and volume in cubic metres" while the memorandum chose the units of measure provided in activity 1.3.2 and provided examples and full names. The whole instruction for this question was ambiguous and only the answer provided in the memorandum gives the indication how question 1.3.1 was to be interpreted. Cleo's response included models without a unit of measure so it was not possible to gauge if she understood what she was doing. Sihle provided two tables for this activity, one table similar to what the teacher explained and a second table with explanations and models, showing that Sihle was unsure about the activity. Also, Sihle showed an understanding of certain units of measure but the teacher overlooked his attempt because it was different from the memorandum. Thabani on the other hand showed a deep understanding by providing a 3 dimensional drawing with the appropriate measure, which was also overlooked because his response differed from the memorandum.

In the second example about the rates of change used in activity 2.2, the answers were mysteriously rounded off to reveal answers given for the 2005/2006 tariffs. However a closer look at the memorandum revealed that in order to achieve perfectly rounded off solutions, the rate could be two, three or even four decimal places. The instruction for this activity did not indicate how many decimal places were to be used.

*The learners resorted to 'number grabbing' techniques when they did not understand the instruction.*

Schoenfeld (1988) was the first to coin the phrase "number grabbing". "Number grabbing" occurs when learners are confronted with problems they do not understand and they then resort to a 'number grab' to enable them to perform calculations and obtain an answer. This phrase captures the essence of the approach used by participants in this study. For example, an examination of Sihle's response of activity 2.1 revealed that he presented his calculations in a table. He then proceeded to grab numbers from the first two columns of the table provided. He grabbed R100 and R230 for the unit type and inserted these numbers into his table. He then grabbed 17, 35 and 36 from the last column of the table provided. He then proceeded to manipulate those grabbed numbers in order to produce a result, without making sense of any of the numbers or of the operations on the numbers.

Cleo also responded to activity 1.4, activity 2.1 and activity 2.3 with a series of number grabs. In question 1.4.4, learners required the answer they obtained in 1.4.3. Cleo extracted the numbers 350 and 60 from 1.4.3. She proceeded to add those two numbers, which resulted in 410. Cleo then squared 410. When 410 was squared a value of 168100 was obtained. It is evident that Cleo was struggling to make sense of question 1.4.4. She looked at 1.4.3 and extracted two numbers. She focused on the numbers, irrespective of whether it was the correct thing to do. Her understanding of the second part of 1.4.4 was that she extracted the two numbers from the previous question, she proceeded with a few calculations and then she answered the question by stating that 410 was the actual answer which she then converted to 168100. For question 1.4.5 Cleo responded to this question with 21497/462, 121009 as a response to percentage increase. The numbers 21497, 462 and 121009 do not appear in question 1.4.5. The number 21497, possibly came from the number 2 149 700. However it seems that because she could not make sense of the question, she provided values that would show some 'calculation'.

For activity 2.1 Cleo was certain that 18 boys and 22 girls needed accommodation. For the girls' accommodation, Cleo ignored the fact that safari tents appeared in two rows. She used the information on safari tents from the second row. For this calculation she divided 22 by 4 and arrived at a decimal value of 5, 5. From this it was clear that Cleo did not make sense of her calculation. If she did she would have realised that one cannot pay for a

0, 5 safari tent or in reality a 0, 5 tent does not exist. She proceeded to multiply the 5, 5 with R36, which she extracted from the second row of safari tents and arrived at a value of R198, 00. Cleo extracted R17, 00 and R36, 00 from the column, which stated 'tariffs for an additional child'. This showed that Cleo did not have an understanding that the boys and girls in this activity would be regarded as adults and not children. Cleo also used the R17 to imply that it cost R17, 00 to use one camping tent. The R17, 00 is 'tariffs for an additional child'.

For activity 2.3 she extracted numbers for question 2.3.2(b), Cleo then provided a very unusual solution. 20 was divided by 46 and divided again by 20. Then 60 multiplied the value, which resulted in the value of 1.30, which was divided by 60 to provide a solution of 0.02. From this response it was evident that Cleo had picked up figures randomly and performed operations, which made no sense. It was also revealed that the teacher's explanations could have influenced Cleo.

*In summary:* The results of the three cases in this study indicate how learners experienced the Common Tasks for Assessment in Mathematical Literacy, Mathematics and Mathematical Sciences. The context played a significant role in how they experienced the CTA, which was also evidenced in the literature reviewed. William (1997) stated that sometimes context bears little or no relation to the mathematics being taught but somehow by engaging learners in such activities, convinces them they are of relevance to learners and linked to the real world.

Boaler (1994) argued that contexts are used in the belief that linking school mathematics with real world problems enhances mathematical learning. On the contrary, in this study, mathematical tasks presented within a 'real-life' context, did not enhance the learners' mathematical learning. An average learner such as Sihle could not make sense of information provided in the table. Cleo, on the other hand extracted numbers and did mathematical calculations that made no sense except to her, while Thabani showed a deep understanding by providing a multifaceted solution to one problem. In another problem Thabani was able to complete the first step correctly. His partial solution was an indication that he chose not to read the table, which had information to continue with the problem.

In her study Boaler (2003) revealed reasons for students experiencing problems with 'real-life' context test items. The first reason was that the test was set in a context that was confusing to linguistic minority and low-income students. The second reason was that most of the answers to tests were closed ended despite being set in a real context. It did not take into account multidimensional answers. The third reason was that the test used long and confusing sentences. These three reasons that Boaler identified are evident in this study.

Firstly, all three learners in the case study speak a home language other than English and all three belong to low-income families. They experienced the Common Tasks for Assessment in a language that was not their first language and which disadvantaged them because of the heavy reliance on language.

Secondly, from the marking memorandum provided, it was evident in some cases that the method had been prescribed and that the memorandum did not consider alternative responses. For activity 1.3.1, Sihle and Thabani responded to units of measurement according to their interpretations. Sihle provided a sketch of a road for the unit measure 'km', and Thabani provide a shaded sketch of a rectangle to indicate "area". The memorandum was restricting because a variation of responses was not considered. Once again these learners were disadvantaged as a result of a restrictive memorandum.

Thirdly, the CTA contained long and confusing sentences. This was evident in activity 1.4 which had long and confusing sentences. For this activity, Cleo tried to make sense of the textual information, and extracted numerical values from the text and proceeded to do calculations that made no sense. In addition, activity 2.1 had long confusing sentences and information spread across three pages with which both Thabani and Sihle experienced problems. These activities also disadvantaged the learners in this study.

Boaler (2003) considered the inequities that are created by standardised tests. In her study she found that in a low-income school, although learners made incredible achievements, they were labelled as 'under performing' due to the writing of standardised tests which were base on 'real-life' context. This was evidenced in this study, were all three learners are average to excellent mathematics students but performed poorly in the CTA.

These learners' experiences are not unique, Brenner (2002), after extensive research on including everyday mathematics into the classroom, stated that written materials cannot replicate practices outside the classroom. The 2005 CTA is a piece of written material, which attempts to replicate a practice outside the classroom. The problem with this as Murray (2003) stated is that learner's experience 'real life' very differently from adults and the 'so-called' real-life contexts are not necessarily accessible to all learners. This was evidenced with Sihle's, Thabani and Cleo's responses to activity 1.3.1. They were not able to relate to the written context and provided unusual interpretations and solutions to the activity. For that reason Prestage & Perks (2001) stated that most of the time, problems that are in context, although the context may be 'real', "it is hardly relevant to anyone other than the question setter".

## 6.4 MERITS OF THE STUDY

This study made use of four data collection instruments that set off the study in yielding rich data on how learners experienced the common tasks for assessment in mathematics, mathematical literacy and mathematical sciences. Through the use of the four data collection instruments, triangulation was possible.

The findings from this research are applicable to other grade 9 mathematics learners whose home language is not in the Language of Teaching and Learning, who are not proficient in the Language of Teaching and Learning, and who undertake the Common Tasks for Assessment in Mathematical Literacy, Mathematics and Mathematical Sciences which are based on 'real-life' context. Learners from other grade 9 mathematics classes might share the same views, perceptions and experiences about the Common Tasks for Assessment, irrespective of the location of their schools.

It is acknowledged that the Common Tasks for Assessment in Mathematical Literacy, Mathematics and Mathematical Sciences was used to validate assessment. Whilst mathematics has its own language, learners in this study are taught through the medium of English. Consequently language plays a significant role in how learners interpret and make meaning especially for those learners who are not proficient in English. Nevertheless, the

CTA for MLMMS was used to validate continuous assessment. However it has to address barriers to learning.

This study was not about the CTA, it was about how learners experienced the CTA for MLMMS, which are based on 'real-life' context. Generally mathematics set in context is used conveniently as a means to motivate pure mathematical reasoning. On the contrary Cooper & Harries (2002) propose that if "textually represented realistic contexts" are to serve beyond the purpose of mathematical reasoning, then "designers of high stakes assessment tasks", subsequently have to change the criteria for assessing children on such items. Because, according to them, the marking memorandum should take into account realistic considerations and not provide "one-off" and very "selective" solutions (p. 21). Additionally, Cooper and Dunne (1998a; 1998b), imply that mathematics tasks set in context may have unintended and "perverse consequences" such as equal opportunities issues.

From my study, the use of contexts and the equal opportunities issues has a double impact. Firstly, the contexts were not part of learners' experiences and therefore they could not draw from that experience to answer certain questions. Secondly the results learners obtain in Grade 9, in South Africa, impacts on whether they take Mathematics or Mathematical Literacy in Grade 10. This also has huge policy implications especially with equity issues in testing since mathematics is so important for further education and "children's success or failure in mathematics is a key factor in the determination of their subsequent life chances" (Cooper & Dunne, 1998, p. 142). William (1997) reports that it is unpreventable that "an inherent and unavoidable tension exists" in the use of contexts in the teaching and assessing of mathematics. Taking all of this into consideration, Cooper and Dunne (2004) put forward that "test designers need to give careful thought to just what it is they are testing" (p. 88).

The impact the CTA had on the learners in my study has significant implications for the designers of the CTA and policy makers, because with multicultural and diverse language learners found in the same classroom, I do not believe that their experiences are unique to my school.

## 6.5 IMPLICATIONS/RECOMMENDATIONS

From the findings of the study, the following recommendations are made:

### 6.5.1 For educators of grade 9 mathematics

- Be prepared. Read the CTA, and be aware of the different tasks and what each task entails. Modify speech; speak slowly and clearly without speaking louder. Pause between sentences.
- Many learners are not English first language speakers therefore explanations should take language into consideration.
- The CTA should not be rushed.
- The role of teacher is to guide and assist learners.

### 6.5.2 For the Department of Education

- The study reveals that there is a need for the Department of Education to reassess the design of the CTA for MLMMS.
- The CTA for MLMMS should not be based on one type of mathematical skill, which is problem solving. The CTA for MLMMS should contain routine problems, non-routine problems, problems that can be solved through multiple approaches and open-ended problems.
- There is a need for the Department of Education to set up a committee to visit schools to maintain that the Common Tasks for Assessment are administered as per department regulations.
- There is a need for workshops by the Department of Education by the examiners of the CTA for MLMMS on how the CTA should be administered.

### 6.5.3 Implications for further research

The findings in this research revealed how learners experienced the CTA for MLMMS, which were based on the Kruger National Park. This study identifies areas that need further research.

- A study could investigate learners` anxieties and attitudes towards the CTA for MLMMS.

- A comparative study of First Language English learners, learners who are not proficient in English and how these learners experience the CTA for MLMMS, which are based on real- context.
- A study could investigate question complexity and learner performance.
- A study based on the readability of mathematics assessment tasks using readability formulas.
- A comparative study between schools in affluent areas to those schools that service learners from low socio-economic areas as well as low-income groups.

## 6.6 CONCLUSION

The aim of this study was to explore how learners experienced the CTA, which was grounded in 'real-life' context. My study revealed that learners experienced problems with the CTA, which was grounded in the context of the Kruger National Park. Also, the learners' perceptions revealed that they would have preferred decontextualised items as opposed to contextualised items. The readability of the CTA revealed that some crucial questions were set a level higher than that of an average grade nine learner. The learners in my study are not anywhere close to being average readers of English because the average applies to first language learners and my learners are second language learners. My study also revealed that the manner in which the teacher mediated the CTA was more of a hindrance than a help to the learners.

Finally, the CTA was a summative assessment used as a validity tool to determine what learners' capabilities are. However the study revealed that the CTA was not fair because for the participants, the context of holiday bookings was out of their experience; the teachers marking was inconsistent; the teacher often provided incorrect information; the participants did not fully understand the instructions and the participants did not understand the specialised language used in the context. Therefore the CTA is not a good indicator of what learners can and cannot do.

The Common Tasks for Assessment needs to be more closely aligned with the curricular outcomes. It must address barriers to learning and consequently the challenge is to determine a standard that can be realistically applied to all learners across the country.

## 6.7 SUMMARY

In this chapter I provided answers to the three research questions. I also compared learners' experiences to literature discussed in the literature review. Merits of the study were also presented as well as implications, suggestions and recommendations and finally I provided a conclusion to my study.

## References


Allan, S., McGhee, M., & van Krieken, R. (2005). *Using Readability Formulae for Examination Questions*. QCA, 83 Piccadilly, London, W1J 8QA. United Kingdom: Qualifications and Curriculum Authority.

Allen, F. B. (1988). *Language and the Learning of Mathematics.* Paper presented at the NCTM Annual Meeting, Chicago.

Arcavi, A. (2002). The Everyday and the Academic in Mathematics. In M. Brenner & J. Moschkovich (Eds.), *Everyday and Academic Mathematics in the Classroom* (pp. 12-29). Virginia: National Council of Teachers of Mathematics.

Atkinson, P., & Delamont, S. (2006). Interviewing in Qualitative Research. *Qualitative Research, 6*(4), 311-333.

Au, K. H. (1998). Social Constructivism and the School Literacy Learning of Students of Diverse Backgrounds. *Journal of Literacy Research, 30*(2), 297-319.

Bansilal, S. (2006). *South African grade 9 mathematics teachers, professional expertise: A situative perspective.* Unpublished Doctoral thesis, Curtin University of Technology, Perth, Australia.

Bansilal, S., & Wallace, J. (2008). National Performance Assessment in a South African Context: A case Study of Issues of Classroom Implementation and Task Design. *African Journal of Research in Science, Mathematics and Technology Education* (12), 77-92.

Bell, J. (1991). *Doing Your Research Project.* Milton Keynes: Open University Press.

Boaler, J. (1993). The Role of Contexts in the Mathematics Classroom: do they make mathematics more real? *For the learning of Mathematics, 13*(2), 12-17.

Boaler, J. (1994). When do girls prefer football to fashion? An analysis of female under achievement in relation to realistic mathematics contexts. *British Educational Research Journal, 20*(5), 551-564.

Boaler, J. (1998). Open and Closed Mathematics Approaches: Student Experiences and Understandings. *Journal for Research in Mathematics Education, 29*(1), 41-62.

Boaler, J. (1999). Participation, Knowledge and Beliefs: A community Perspective on Mathematics Learning. *Educational Studies in Mathematics* (40), 259-281.

Boaler, J. (2003). When Learning no Longer Matters - standardized testing and the creation of inequality. *Phi Delta Kappan, 84*(7), 502-506.

Boeree, C. G. (1998). The Qualitative Methods Workbook. *Qualitative Methods Workbook.* Retrieved 5 January 2008, from http: // www. yccc. edu/../ References. doc

Brenner, M. E. (2002). Everyday Problem Solving and Curriculum Implementation: An invitation to try pizza. In M. Brenner & J. Moschkovich (Eds.), *Everyday and Academic Mathematics in the Classroom* (pp. 63-92). Virginia: National Council of Teachers of Mathematics.

Carraher, D. W., & Schliemann, A. D. (2002). Is Everyday Mathematics Truly Relevant to Mathematics Education. In M. Brenner & J. Moschkovich (Eds.), *Everyday and Academic Mathematics in the Classroom* (pp. 131-153). Virginia: National Council of Teachers of Mathematics.

Civil, M. (2002). Everyday Mathematics, Mathematicians' Mathematics, and School Mathematics: Can we bring them together? In M. Brenner & J. Moschkovich (Eds.), *Everyday and Academic Mathematics in the Classroom* (pp. 40-62). Virginia: National Council of Teachers of Mathematics.

Cohen, L., Manion, L., & Morrison, K. (2000). *Research Methods in Education* (5th ed.). London and New York: Routledge Falmer.

Cooper, B. (1992). Testing National Curriculum mathematics: some critical comments on the treatment of 'real' contexts for mathematics. *The Curriculum Journal, 3*(3), 231-243.

Cooper, B. (2001). Social class and 'real-life' mathematics assessment. In P. Gates (Ed.), *Issues in Mathematics Teaching* (pp. 245-258). London and New York: Routledge Falmer.

Cooper, B., & Dunne, M. (1998a). Anyone for tennis? Social class differences in children's responses to national curriculum mathematics testing. *The Sociological Review, 46*(1), 115-148.

Cooper, B., & Dunne, M. (1998b). *Social class, gender, equity and National Curriculum tests in maths.* Paper presented at the ESRC Project, University of Nottingham.

Cooper, B., & Dunne, M. (2004). Constructing the 'legitimate' goal of a 'realistic' maths item. In Allen B & S. Johnston-Wilder (Eds.), *Mathematics Education* (pp. 69-90). London and New York: Routledge Falmer.

Cooper, B., & Harries, T. (2002). Children's Responses to Contrasting 'Realistic' Mathematics Problems: Just how realistic children are ready to be? *Educational Studies in Mathematics, 49*(2), 1-23.

Department of Education. (1998). *Assessment Policy in the General Education and Training Band, Grades R to 9 and ABET.* Pretoria: Department of Education.

Department of Education. (2000). *Curriculum 2005: Towards a Theoretical Framework.* Pretoria: Department of Education.

Department of Education. (2001). *Revised National Curriculum Statement for Mathematics.* Pretoria: Department of Education.

Department of Education. (2002). *Curriculum 2005: Assessment Guidelines for Inclusion.* Pretoria: Department of Education.

Department of Education. (2002). *Draft Framework for the Development of CTA'S.* Pretoria: Department of Education.

Department of Education. (2002). *Revised National Curriculum Statement Grades R-9, Policy: Mathematics.* Pretoria: Department of Education.

Department of Education. (2003). *Assessment Policy in the General Education and Training Band, Grades R to 9 and ABET.* Pretoria: Department of Education.

Department of Education. (2003). *Interim Policy Framework for Assessment and Promoting learners in Grade 9* (Vol. 461). Pretoria: Department of Education.

Department of Education. (2003). *Teacher's Guide for the Development of Learning Programmes.* Pretoria: Department of Education.

Department of Education. (2005). *Common Tasks for Assessment in Mathematics, Mathematical Literacy and Mathematical Sciences.* Pretoria: Department of Education.

Department of Education. (2006). *National Curriculum Statement Grades R - 9.* Pretoria: Department of Education.

Department of Education. (2007). *Mathematics HOD/SMT Meeting. Planning for 2008.* Retrieved. from.

Eisner, E. (1991). *The Enlightened Eye: qualitative Inquiry and the Enhancement of Educational Practice.* New York: Macmillan.

Epstein, M. (2002). Constructivism [Electronic Version]. *Using Information Effectively in Education.* Retrieved 18 June 2005 from http://www.constructivism.epstein.htm.

Golafshani, N. (2003). Understanding Reliability and Validity in Qualitative Research. *The Qualitative Report, 8*(4), 597-607.

Hitchcock, G., & Hughes, D. (1995). *Research and the teacher.* London: Routledge.

Hoepfl, M. C. (1997). Choosing Qualitative Research: A Primer for Technology Education Researchers. *Journal of Technology Education, 9*(1), 1-17.

Johnson, C. (2008). Measuring the reading age of books and other reading matter. [Electronic Version], 1-19. Retrieved 27 January 2008 from http:///www.timetabler.com/reading.html.

Key, J. P. (1997). Research Design in Occupational Education. In *IRB, Thesis Handbook*: Oklahoma State University.

Kohlbacher, F. (2006). The Use of Qualitative Content Analysis in Case Study Research. *Forum: Qualitative Social Research, 7*(1), 1-38.

Krefting, L. (1991). Rigor in qualitative research: The assessment of trustworthiness. *The American Journal of Occupational Therapy, 45*(3), 214-222.

Lincoln, Y. S., & Guba, E. G. (1985). *Naturalistic Inquiry*. Beverly Hills: Sage Publications.

Masingila, J. O. (2002). Examining Students' Perceptions of their Everyday Mathematics Practice. In M. Brenner & J. Moschkovich (Eds.), *Everyday and Academic Mathematics in the Classroom* (pp. 30-39). Virginia: National Council of Teachers of Mathematics.

Mayring, P. (2000). Qualitative Content Analysis. *Forum: Qualitative Social Research, 1*(2), 1-15.

Merriam, S. B. (1988). *Case Study Research in Education: A Qualitative Approach*. San Francisco, CA: Jossey-Bass.

Merriam, S. B. (2000). *Qualitative Research in Practice*. San Francisco, CA: Jossey-Bass.

Moll, I. (2002). Clarifying constructivism in a context of curriculum change. *Journal of Education* (27), 5-32.

Morrison, K. R. B. (1993). *Planning and Accomplishing School - centred Evaluation*. Norfolk: Peter Francis Publishers.

Moschovich, J. N. (2002a). An Introduction to Examining Everyday and Academic Mathematical Practices. In M. Brenner & J. Moschkovich (Eds.), *Everyday and Academic Mathematics in the Classroom* (pp. 1-11). Virginia: National Council of Teachers of Mathematics.

Moschkovich, J. (2002b). Bringing together Workplace and Academic Mathematical Practices during Classroom Assessments. In M. Brenner & J. Moschkovich (Eds.), *Everyday and Academic Mathematics in the Classroom* (pp. 93-110). Virginia: National Council of Teachers of Mathematics.

Murray, H. (2003). Word problems: A problem! *Pythagoras, 58*, 39-41.

Myburbh, N., Oerson, P., Poggenpoel, M., & Van Rensburg, W. (2004). Learners' Experience of Teaching and Learning in a Second or Third Language. *Education, Spring*, 12 - 22.

Neuman, W. (1997). *Social Research Methods*. Boston: Allyn & Bacon.

Patton, M. Q. (1990). *Qualitative Evaluation and Research Methods*. Newbury Park, CA: Sage Publications.

Poliah, R. (2003). *Enhancing the Quality of Assessment Through Common Tasks for Assessment.* Paper presented at the AEAA Conference, Cape Town.

Prestage, S., & Perks, P. (2001). Context, reality and ambiguity. In S. Prestage & P. Perks (Eds.), *Adapting and Extending Secondary Mathematics Activities*. London: David Fulton Publishers.

Pretorius, J., Potgieter, R., & Ladewig, W. (2005). *Oxford Successful, Mathematical Literacy, Learner's Book.* Cape Town: Oxford University Press Southern Africa.

Schlebusch, G. (2002). Cognition and the Language of Learning in South Africa: A Grade 10 Economics Perspective. *The Qualitative Report, 7*(3), 1-11.

Schoenfeld, A. H. (1988). Problem solving in context(s). In *The teaching and assessing of mathematical problem solving.* Reston,VA: National Council of Teachers of Mathematics.

Sethole. (2004). Meaningful contexts or dead mock reality: which form will everyday take? *Pythagoras* (59), 18-25.

Soy, S. K. (1997). The case study as a research method: University of Texas at Austin.

Sullivan, P., Zevenbergen, R., & Mousley, J. (2003). The Contexts of Mathematics Tasks and the Context of the Classroom: Are We Including all Students? *Mathematics Education Research Journal, 15*(2), 107-121.

Taylor, N. (2000). *'Anything but Knowledge': The Case of the Undisciplined Curriculum.* Paper presented at the International Conference Designing Education for the Learning Society, SLO, Enschede, Netherlands.

Taylor, N., & Vinjevold, P. (1999). Curriculum 2005: Finding a balance between everyday and schoolknowledges. In N. Taylor & P. Vinjevold (Eds.), *Getting Learning Right* (pp. 105-130). Johannesburg: Joint Education Trust.

Tellis, W. (1997). Application of a Case Study Methodology. *The Qualitative Report, 3*(2), 1-18.

Von Glasersfeld, E. (1995). *Radical Constructivism: A Way of Knowing and Learning.* New York: Falmer Press.

Vygotsky, L. (1934). *Thought and Language*. Cambridge, Massachusetts London, England: The MIT Press.

Weitzel, D. (2003). Who's reading your writing? Retrieved 30 November, 2007, from http://www.eduscapes.com/../path3.html

William, D. (1997). *Relevance as MacGuffin in Mathematics Education.* Paper presented at the British Educational Research Association Conference, York.

Yin, R. K. (1984). *Case study research: Design and methods.* Newbury Park, CA: Sage.

Zevenbergen, R. (2001). Language, social class and underachievement in school mathematics. In P. Gates (Ed.), *Issues in Mathematics Teaching* (pp. 38-50). London and New York: Routledge Falmer.

## APPENDICES

A Common Tasks for Assessment for MLMMS for 2005

# DEPARTMENT OF EDUCATION

education

Department:
Education
REPUBLIC OF SOUTH AFRICA

**MATHEMATICAL LITERACY, MATHEMATICS AND MATHEMATICAL SCIENCES**

**(MLMMS)**

Common Tasks for Assessment (CTA)
Grade 9
2005

**LEARNER'S BOOK**

**Time: 5 hrs**

**✓ Marks: 100**

**No. Pages: 19**

**THE COMMON TASKS FOR ASSESSMENT (CTA)**

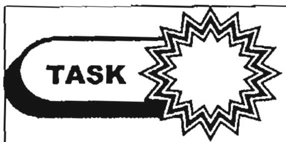
**PHASE ORGANISER:** Environment

**PROGRAMME ORGANISER:** Utilising and protecting natural resources

**FOCUS:** In which way does the Kruger National Park utilise and protect natural resources?

- This CTA should be completed within FIVE hours, which may be spread over a number of days.
- Answer the CTA in your exercise book or in the way you and your teacher agreed upon.
- You will do some of the activities as an individual and others as a member of a group or pair. You may consult or ask for help. In the end you must be able to justify all your answers.
- It is important to show all your calculations because then your teacher will be able to see how you have reasoned and which skills and knowledge you have applied.

**Icons Used:**




**Task:**
This indicates that a new task has begun.

**Resources:**
What you will need to complete the activity.

**Activity:**
This indicates that a new activity in the task has begun.

**Instructions:**
What you need to do.

Individually

Pairs

Groups

Activities are done individually, in pairs or in groups.

CONTENTS

**Glossary**

| | |
|---|---|
| base occupancy | number of people who can stay in the unit without paying additional tariff |
| census | official counting process |
| culling | legal selection and killing to reduce the numbers of animals |
| diversity | many different kinds |
| encroachment of man | moving into territory (area) of other and usually taking over |
| fluctuation | rise and fall |
| frenzy | rush; do too quickly |
| max beds | maximum number of beds available in the unit |
| moratorium | legal instruction to postpone |
| poaching | illegal killing or capturing of game |
| slaughtered | killed |
| sustainable | on-going |
| tariff | Cost; rate; fare |
| tendency | following the same pattern |
| unique | one of a kind |
| unrivalled | having no equal; unmatched |

**CONTEXT**

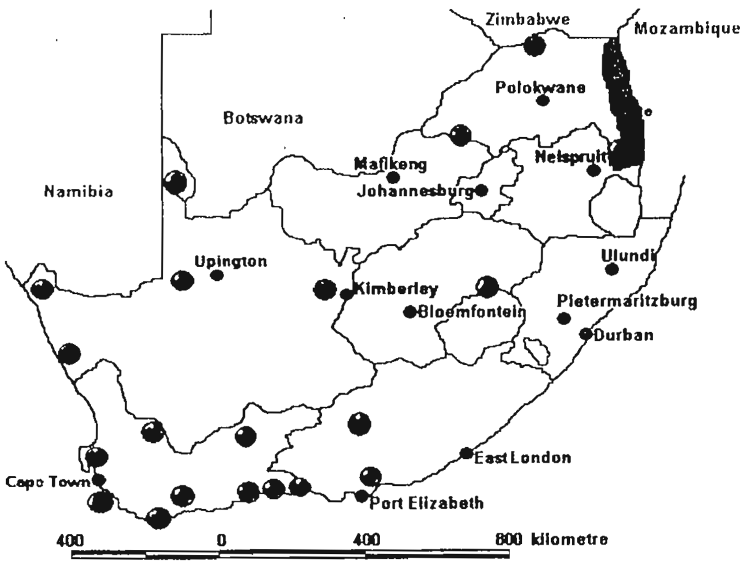
The world-renowned Kruger National Park (KNP) is the largest game reserve in South Africa. It is situated in the eastern part of the country, bordering Mpumalanga, Limpopo and Mozambique. It is unrivalled in its diversity of species and is a recognised leader in environmental management techniques and policies. Because of the wide variety of wild animals, small and large game, the game reserve attracts a large number of tourists, but it also attracts poachers.

**TASK 1** **NATIONAL PARKS**

**Recommended time: 27min** | **✓ Marks: 27**

In this task you will be assessed on your ability to:
- Use a scale to determine actual distances between two points on a map.
- Calculate area.
- Convert from one unit to another.
- Explain estimations.
- Calculate percentage increase.

**South African National Parks** are spread all over the country as shown on this map.




(courtesy www.SANparks.org)

1. Addo Elephant National Park
2. Agulhas National Park
3. Augrabies Falls National Park
4. Bontebok National Park
5. Golden Gate Highlands National Park
6. Karoo National Park
7. Kgalagadi Transfrontier Park
8. Knysna National Lake Area
9. Kruger National Park
10. Mapungubwe National Park
11. Marakele National Park
12. Mountain Zebra National Park
13. Namaqua National Park
14. Richtersveld National Park
15. Table Mountain National Park
16. Tankwa Karoo National Park
17. Tsitsikamma National Park
18. Vaalbos National Park
19. West Coast National Park
20. Wilderness National Park

**Activity 1.1**

**Recommended time: 10 min**

**Groups**

**Marks: 0**

Discuss the following and give feed back to the class:

1.1.1 Why is it necessary to have national parks?

1.1.2 How can communities close to parks benefit from their existence?

1.1.3 The location of your school on the map (make a dot).

1.1.4 Which South African National Park is closest to your school?

**Activity 1.2**

**Recommended time: 10 min**

**Pairs**

**Marks: 5**

In this activity you will have to work with the conversion of distances using scale. The scale for a map or plan can be given in different ways.

- Discuss how the scales in the shaded rows in table 1 work.
- Complete the table by converting the **distances measured** on a map to **actual distances** (1.2.1 – 1.2.3 or choose a **scale** which will describe a conversion (1.2.4)

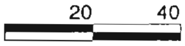
| Scale | Distance measured on map | Actual distance |
|---|---|---|
| [illegible] | [illegible] | [illegible] |
| 1 mm is 10 km | 28 mm | 1.2.1............ |
| [illegible] | [illegible] | [illegible] |
| 1:100 000 | 3 cm | 1.2.2............ |
| [illegible] | [illegible] | [illegible] |
| 20 40 km  |  | 1.2.3............ |
| (Try more than one scale) 1.2.4.................... | 20 mm | 40 km |

Table 1

**Activity 1.3**

Pairs

Recommended time: 25 min

Marks: 5

You also need to know how to convert between units of distance, area and volume.

1.3.1 Use Table 2 to discuss units of measurement, their purpose and their actual size.

Present the information in table form using appropriate headings as follows:

- List all units of measurement mentioned in Table 2.
- Classify them according to their purpose (measuring distance, area or volume).
- Write out their full names.
- Draw or make a model of each unit according to its actual size. If the unit is too big to draw or model, give an example (describe in words) of something the size of that unit.

1.3.2 Discuss how to convert from one unit to another and complete the following table:

| Units | |
|---|---|
| 25 mm | .....cm |
| .....cm$^2$ | 2 m$^2$ |
| .....mm$^2$ | 600 cm$^2$ |
| 500 cm$^3$ or m$\ell$ | .....$\ell$ |
| .....m | 1,5 km |
| 12 000 m$^2$ | ......ha |
| 3 000 mm$^2$ | .....cm$^2$ |
| ......ha | 20 km$^2$ |
| 75 cm | .....m |
| 6 000 $\ell$ | .....m$^3$ |

Table 2

**Activity 1.4**

Individual

Recommended time: 30 min

Marks: 17

1.4.1 (a) Use the map on page 4 to estimate the distance from your school to the marked entrance to the Kruger National Park. (5)

(b) Why can the answer in (a) only be an estimation? Give two reasons. (2)

1.4.2 When the CTA was copied at a certain school the map on page 4 was reduced to 80%. What influence can this have on your answer in 1.4.1? Explain your answer. (3)

1.4.3 Up to 1994 the KNP stretched 350 km along the Mozambican border and was on average 60 km wide. Use this information to determine the approximate area of the Park before 1994, in km$^2$. (2)

1.4.4 According to one source, the actual area of the Kruger National Park before 1994 was 2 149 700 hectares. Convert your answer from 1.4.3 to hectares and explain why your answer differs from the actual area. (2)

1.4.5 According to an agreement with the governments of Mozambique and Zimbabwe, the Kruger National Park will become part of the Greater Limpopo Transfrontier Park. The eventual size of this Park will be 100 000 km$^2$. Calculate the percentage increase of this Park compared to the size of the Kruger National Park before 1994 (2 149 700 ha). (3)

TASK 2 **TOURING THE KRUGER NATIONAL PARK**

**Recommended time: 105min** ✓ **Marks: 27**

In this Task you will be assessed on your ability to:

- Read information from tables and maps
- Use information to make calculations in order to make informed decisions
- Investigate rates of change in prices
- Do calculations involving speed, distance and time
- Translate information from a tally table to a bar graph

Activities in task 2 will be based on the information found on the following two pages.

**Accommodation in the Kruger National Park**

Skukuza, "the capital of the Kruger National Park", offers visitors a unique experience. Skukuza is by far the largest camp in the Park with over 200 huts, with shops, a restaurant, a movie theatre, doctor's rooms, a petrol station, and a huge camping area, etc. It resembles a small town rather than a rest camp!

**General Booking Information**

- Adult is 12 years or above.
- Child (2-11 years) under 2 years, free.
- All prices include VAT.
- **All Tariffs in South African Rand. Tariffs are subject to alteration without advance notice.**

Additional Person Supplements are applicable to those units where the number of beds needed exceeds the base occupancy.

**TARIFFS FOR ACCOMMODATION**

**Tariffs are from November 2004 to October 2005**

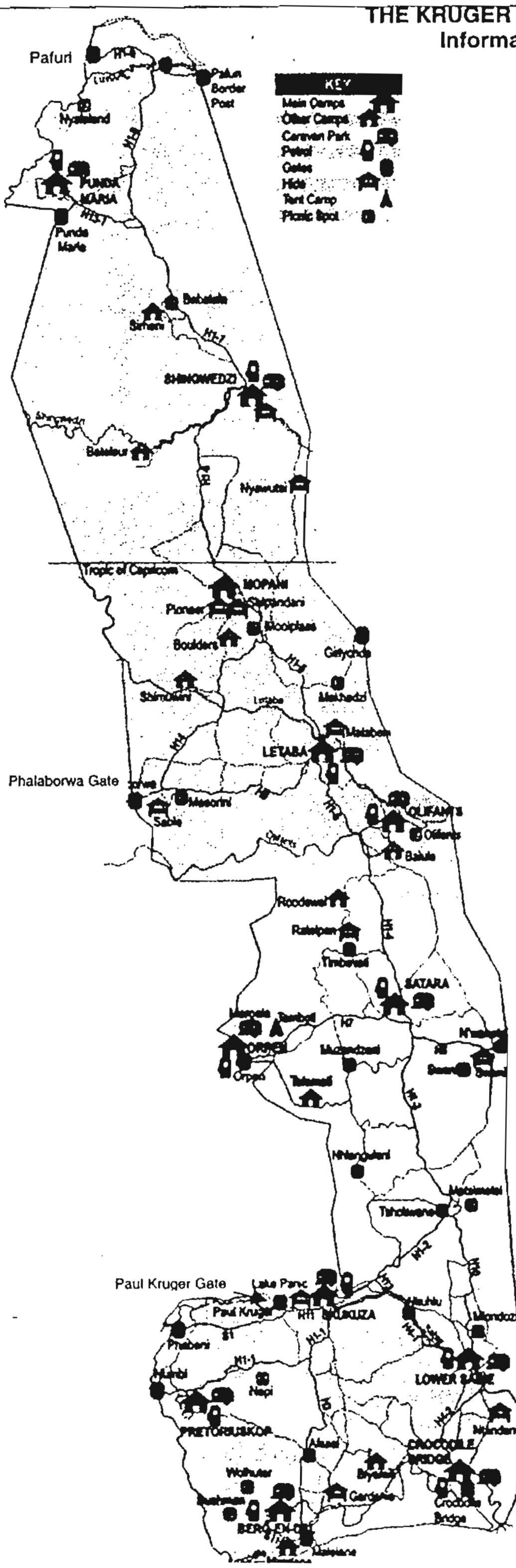
**KEY: CK** = communal kitchen **K** = Hotplate and sink **DB** = Double bed

| Unit type | No. of units | Tariffs per unit per day | Base occupancy | Max. beds | Tariffs for an additional adult | Tariffs for an additional child |
|---|---|---|---|---|---|---|
| | | 2004/05 | | | 2004/ 05 | 2004/ 05 |
| Camping | 80 | 100,00 | 1 - 2 | 6 | 35 | 17,00 |
| Safari Tent – communal facilities | 12 | 230,00 | 1 - 2 | 2 | N/A | 36,00 |
| Safari Tent – communal facilities | 8 | 230,00 | 1 – 2 | 4 | 70,00 | 35,00 |
| Bungalow CK | 117 | 460,00 | 1 – 2 | 2 or 3 | 100,00 | 50,00 |
| Bungalow K | 61 | 495,00 | 1 – 2 | 2 or 3 | 100,00 | 50,00 |
| Luxury Bungalow | 5 | 770,00 | 1 – 2 | 1 DB | N/A | N/A |
| Luxury Riverside Bungalow | 15 | 885,00 | 1 - 2 | 1 DB | N/A | N/A |
| Family Cottage | 1 | 850,00 | 1 - 4 | 4 | N/A | 180,00 |
| Guest Cottage | 6 | 850,00 | 1 - 4 | 4 | N/A | 180,00 |
| Guest Cottage | 7 | 850,00 | 1 - 4 | 6 | 180,00 | 180,00 |
| Guest Cottage | 2 | 850,00 | 1 - 4 | 6 (2 DB) | 180,00 | 180,00 |
| Guest House *Moni* | 1 | 1600,00 | 1 - 4 | 8 | 300,00 | 300,00 |
| Guest House *Nyathi, Waterkant 1* | 3 | 1600,00 | 1 - 4 | 8 (2 DB) | 300,00 | 300,00 |
| Guest House *ABSA* | 1 | 1600,00 | 1 - 4 | 12 (4 in lounge) | 300,00 | 300,00 |

(courtesy www.SANparks.org)

Table 3

# THE KRUGER NATIONAL PARK
## Information sheet




| Opening and Closing Times | | | | |
|---|---|---|---|---|
| | Open | | Close | |
| | Camps | Gates | Camps | Gates |
| January | 04:30 | 05:30 | 18:30 | 18:30 |
| February | 05:30 | 05:30 | 18:30 | 18:30 |
| March | 05:30 | 05:30 | 18:00 | 18:00 |
| April | 06:00 | 06:00 | 18:00 | 18:00 |
| May | 06:00 | 06:00 | 17:30 | 17:30 |
| June | 06:00 | 06:00 | 17:30 | 17:30 |
| July | 06:00 | 06:00 | 17:30 | 17:30 |
| August | 06:00 | 06:00 | 18:00 | 18:00 |
| September | 06:00 | 06:00 | 18:00 | 18:00 |
| October | 05:30 | 05:30 | 18:00 | 18:00 |
| November | 04:30 | 05:30 | 18:30 | 18:30 |
| December | 04:30 | 05:30 | 18:30 | 18:30 |

Table 4

**Kruger National Park - Distance Table**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Letaba | | | | | | | |
| 160 | Lower Sabie | | | | | | |
| 35 | 145 | Olifants | | | | | |
| 170 | 57 | 156 | Paul Kruger Gate | | | | |
| 52 | 212 | 86 | 222 | Phalaborwa Gate | | | |
| 67 | 93 | 52 | 104 | 118 | Satara | | |
| 160 | 46 | 145 | 12 | 211 | 92 | Skukuza | |
| 119 | 42 | 104 | [illegible] | [illegible] | [illegible] | [illegible] | Tshokwane |

Table 5

50 speed limit on tar roads

40 speed limit on gravel roads

## INFORMATION, RULES AND REGULATIONS

- Visitors must report at reception in camps where they want to stay overnight.
- Occupancy from 12:00 on day of arrival and vacate before 09:00 on day of departure.
- No disturbance is allowed. No noise is allowed between 21:00 and 06:00.
- No bicycles, roller-skates or skateboards may be used.
- Visitors are not allowed to trade inside the Park.
- Visitors should stay inside their vehicles when outside camps, unless otherwise indicated.
- Obey all traffic rules. Remember animals have the right of way
- Only persons with a valid driver's license are allowed to drive.

**Help to conserve the environment**

- No animal, plant or bird may be fed, disturbed or removed.
- Fire kills. Do not start any fire through negligence.

**Important**

- No domestic animals are allowed.
- Littering is prohibited.
- Fire arms must be declared on arrival at the gates.
- The Park is situated in a malaria infested aria. Visitors should take the necessary anti-malaria medication which is also available at the gates and main camps.

(courtesy www.SANparks.org)

You are a member of the LRC (Learner Representative Council) of a school. The LRC arranged a short tour of 3 days and 2 nights through the Kruger Park for a group of 40 grade 9 learners (22 girls and 18 boys) in July 2005. The programme was as follows:

| DAY 1: | DAY 2 | DAY 3 |
|---|---|---|
| • Depart from the school at 06:00<br>• Arrive at Skukuza: 16:00<br>• Supper at Skukuza<br>• Film and slide show on nature conservation in the Kruger National Park<br>• Overnight at Skukuza | • Depart from Skukuza as soon as the gates open.<br>• Bus drive and game spotting<br>• Breakfast at Lower Sabie.<br>• Bus drive and game spotting<br>• Refreshments at Tshokwane.<br>• Bus drive and game spotting<br>• Traditional braai at Satara<br>• Night drive and game spotting<br>• Overnight at Satara. | • Breakfast at Satara<br>• Bus drive and game spotting<br>• Refreshments at Letaba<br>• Bus drive and game spotting<br>• Exit Park at Phalaborwa Gate. |

**Activity 2.1**

Recommended time: 15 min

Individual

Marks: 5

Use table 3 to complete this activity. Calculate the minimum amount that could have been paid for the accommodation at Skukuza Rest camp. The following factors should be taken into account:

- the boys were accommodated in unit type "Camping" and
- the girls in unit type "Safari Tent".

**Activity 2.2**

Recommended time: 20 min

Groups

Marks: 8

This table also includes tariffs for the 2005/2006 season

| Unit type | Tariffs | |
|---|---|---|
| | **2004/05** | **2005/06** |
| Camping | 100,00 | 105,00 |
| Safari Tent – communal facilities | 230,00 | 240,00 |
| Bungalow CK | 460,00 | 480,00 |
| Bungalow K | 495,00 | 515,00 |
| Luxury Bungalow | 770,00 | 800,00 |
| Luxury Riverside Bungalow | 885,00 | 920,00 |

Table 6

2.2.1 Investigate the rate at which the tariffs for accommodation have been increased from 2004/2005 to 2005/2006. Show all your calculations. Present your findings in tabular form by adding columns to Table 6.

2.2.2 Calculate the 2006/2007 tariffs for Camping and Safari tents based on the rate of increase you identified. Round the tariffs off to the nearest R5,00.

**Activity 2.3**

**Recommended time: 40 min**

**Individual**

**Marks: 9**

(Total marks for 2.3.1 to 2.3.4 will be divided by 2 to give the 9 marks)

2.3.1 Use the information on page 8 to find the speed limit on tar roads inside the Park. Use this speed limit to determine at what estimated time the group might have reached Lower Sable if they had left Skukuza when the gates opened. Give the answer to the nearest minute.

2.3.2 The experienced driver of the bus said that the average speed travelling through the Park is 20 km per hour.

a) Give two possible reasons why this speed is much slower than the speed limit.

b) Travelling at an average speed of 20 km/h, determine the time when the tour group reached Lower Sabie Rest Camp.

2.3.3 The bus left Lower Sabie at 9:30 and reached Satara Rest Camp at 16:00. What was the average speed on this part of the journey?

2.3.4 On day 3 the tour group left Satara at 6:00 and travelled to Phalaborwa Gate via Letaba Rest Camp at an average speed of 20 km/h. If they exited the Park at Phalaborwa Gate at 12:30 how long could they have stayed in Letaba Rest Camp?

**Activity 2.4**

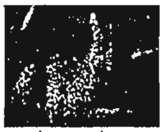
**Recommended time: 30 min**

**Groups**

**Punte: 5**

(Total marks for 2.4.1 and 2.4.2 will be divided by 2 to give the 5 marks)

One of the exciting things about visiting the Park is to spot the Big Five. Lesiba kept a tally table of the numbers spotted by the learners during their tour:

| Elephant | Rhinoceros | Leopard | Lion | Buffalo |
|---|---|---|---|---|
|  www.zulunet.co.za |  www.zulunet.co.za |  www.krugerpark.co.za |  www bigfive-safaris co.za |  www.krugerpark.co.za |
| 𝍸 𝍸 𝍸 𝍸 𝍸 𝍸<br>𝍸 𝍸 𝍸 𝍸 | 𝍸 // | / | 𝍸 𝍸 //// | 𝍸 𝍸 𝍸 𝍸 𝍸 𝍸<br>𝍸 𝍸 𝍸 𝍸<br>𝍸 𝍸 𝍸 𝍸 𝍸 𝍸<br>𝍸 𝍸 𝍸 𝍸<br>𝍸 𝍸 𝍸 𝍸 𝍸<br>𝍸 𝍸 /// |

When they got back home the tour group made a presentation to the school about their educational tour. Lesiba wanted to present the information about the Big Five on a bar graph.

2.4.1 Draw Lesiba's bar graph presenting the numbers of the Big Five they spotted on the grid paper provided in Annexure A.

You will be assessed on the following:

- The suitability of the title of the graph
- The relevancy of the names of the axes
- The scale you have chosen
- The proportionality of the bars with regard to the numbers presented.
- The general appearance of the presentation

2.4.2 Discuss in groups why one might observe many of one species and less of another.

**THE COMMON TASKS FOR ASSESSMENT (CTA)**

| | |
|---|---|
| PHASE ORGANISER: | Environment |
| PROGRAMME ORGANISER | Utilizing and protecting natural resources |
| FOCUS: | The Kruger National Park |

**Icons Used:**


**Task:** This indicates that a new task has begun.

**Resources:** What you will need to complete the activity.

**Activity:** This indicates that a new activity in the task has begun.

**Instructions:** What you need to do.

**Individually X**
**Pairs TY**
**Groups TYX**

Activities are done individually, in pairs or in groups.

CONTENTS





## SUMMARY OF TASKS AND ACTIVITIES

NOTE:

The time allocations as per task given in this summary are merely intended as a guide. Teachers can adjust time allocated to each task and its related activities according to the pace and needs of the learners. However, it must be kept in mind that the total time allocation of this Common Task for Assessment is 5 hours.

| Tasks | Related activities | SOs addressed | Time allocation | Mark allocation | Form of assessment | Assessment method | Resources |
|---|---|---|---|---|---|---|---|
| 1. National parks | Activity 1.1 | 4.6 | 10 min | No marks | Class work | | Map indicating National Parks |
| | Activity 1.2 | 6 | 10 min | 5 | Class work | Peer assessment | Copy of Table 1 |
| | Activity 1.3 | 5.2 | 25 min | 5 | Class work | Peer assessment | Copy of Table 2 |
| | Activity 1.4 | 4.6, 5.2, 1.5, 1.3 | 30 min | 17 | Assignment | Teacher assessment | Map and ruler |
| | | | 75 min | 27 marks | | | |
| 2. Touring the Kruger National Park | Activity 2.1 | 1.6, 10.1 | 15 min | 5 | Homework - Problem solving | Teacher assessment | Table 3 |
| | Activity 2.2 | 1.6, 1.7, 2.3 | 20 min | 8 | Investigation | Teacher assessment | Copy of Table 6 Any appropriate resource |
| | Activity 2.3 | 4.6, 1.5 | 40 min | 9 | Assignment | Teacher assessment | Table 5 |
| | Activity 2.4 | 6.5, 6.8 | 30 min | 5 | Class work - translation | Group assessment | Grid paper or Annexure A Any appropriate resource |
| | | | 105 min | 27 marks | | | |
| 3. Upgrading accommodation in Skukuza | Activity 3.1 | 5.2 | 5 min | No marks | Class work | Self assessment | Copy of Table 7 Any appropriate resource |
| | Activity 3.2 | 5.2, 7.3 | 30 min | 12 | Class work | Teacher assessment | Any appropriate resource |
| | Activity 3.3 | 2.4, 5.2, 7.2 | 20 min | 5 | Assignment | Peer assessment | Copy of Table 8 Grid paper – Annexure B |
| | | | 55 min | 17 marks | | | |
| 4. Animal management and control | Activity 4.1 | 2.3, 1.6 | 25 min | 6 | Assignment | Teacher assessment | Copy of Table 9 Any appropriate resource |
| | Activity 4.2 | 6.5, 6.7, 2.3 | 40 min | 23 | Assignment | Teacher assessment | Grid paper or Annexure B Table 10 Any appropriate resource |
| | | | 65 min | 29 marks | | | |
| | | Total: | 5 hours | 100 | | | |

### General information

- The CTA should be integrated into the normal class activities during the period of administration.
- It should be completed within FIVE hours, which should be spread over a number of days. These FIVE hours are meant for the completion of the activities only – **not for discussions and consultation.**
- The CTA should be answered in exercise books or in a way you and your learners agreed upon.
- Allow learners to discuss activities with each other and with you. Individual learners should be able to explain each response he/she hands in.
- Encourage learners to hand in complete responses showing all calculations and conclusions and necessary explanations so that you can assess their skills, knowledge, ability to reason, solve problems and communicate mathematics.
- Provide learners with relevant resources to facilitate conceptual development and understanding

MEMORANDUM

NOTE TO TEACHERS:

Teachers must not only look at the final answers. Marks should be awarded for the correct reasoning processes.

HINT: Where necessary, read the activity and its related questions to the learners at the start of an activity. Revise all skills and knowledge necessary to do the activity. Some activities include scaffolding activities to assist learners. These can also be supplemented if the teacher deems it necessary. Allow learners to consult until they are comfortable to do the activity independently and can justify all their responses.

## TASK 1 NATIONAL PARKS

Recommended time: 75min

Marks: 27

### Activity 1.1

Groups

Recommended time: 10 min

Marks: 0

This activity is meant to serve as an introduction and should not be left out because no marks are attached to it.

| Act no | Possible answers | Mark allocation | Marks | |
|---|---|---|---|---|
| 1.1.1 | To conserve nature and animals for future generations, etc | No marks | 0 | |
| 1.1.2 | Job opportunities inside the parks<br>Entrepreneurial opportunities:<br>- Entertainment of tourists<br>- Making and selling of artefacts<br>- Hospitality industry, etc | No marks | 0 | |
| 1.1.3 | If available, use a more detailed map to estimate the position of the school and transfer the information proportionally to the given map. | No marks | 0 | |
| 1.1.4 | If more than one national park is close to the school, measure the distances to establish which one is the closest. | No marks | 0 | 0 |



### Activity 1.2

Pairs

Recommended time: 10 min

Marks: 5

**Peer assessment**

Discuss the use of scale with the learners if this has not been done before. Make them aware that scale is used to enlarge or reduce the size of something we want to present proportionally.

| Act no | Possible answers | Mark allocation | | Mar |
|---|---|---|---|---|
| 1.2.1 | $\frac{28mm}{1mm} \times 10km = 280km$ | Multiplying 10 km by 28<br>Correct answer | 1 mark<br>1 mark | |
| 1.2.2 | 3 cm x 100 000 = 300 000cm | Multiplying 3cm by 100 000<br>Correct answer | 1 mark<br>1 mark | |
| 1.2.3 | $\frac{45}{15} \times 20km = 60km$<br>(providing the dimensions did not change during the duplicating process. Even so the answer should still be 60 km) | Measuring distances x and y correctly<br>Dividing the two numbers in the correct order<br>Correct answer | 2 marks<br>1 mark<br>1 mark | |
| 1.2.4 | 1.200 000 or<br>1 mm is 2 km or<br>20 40 km | Any acceptable version of a scale | 2 marks | 10 |

## Activity 1.3

Pairs

Recommended time: 25 min

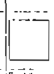
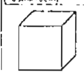
Marks: 5

### Peer Assessment

Allow learners to discuss this activity until everybody has a clear knowledge and understanding of these units and their relatedness. Let the learners mark each others' responses.

| Act no | Possible answers | Mark allocation | Marks | |
|---|---|---|---|---|
| 1.3.1 | (see table below) | **Classifications:**<br>7 or more correct 2 marks<br>Less than 7 correct 1 mark<br>**Full names:**<br>7 or more correct 2 marks<br>Less than 7 correct 1 mark<br>**Examples:**<br>7 or more correct 2 marks<br>Less than 7 correct 1 mark | 6 | |
| 1.3.2 | (see table below) | **Conversion:**<br>7-10 correct 4 marks<br>5-6 correct 3 marks<br>3-4 correct 2 marks<br>1-2 correct 1 mark | 4 | $\frac{10}{2}=5$ |

1.3.1

| Distance | Area | Volume | Full name | Example |
|---|---|---|---|---|
| mm | | | millimetre | |
| cm | | | centimetre | |
| m | | | metre | The same as the half the height of a standard door |
| km | | | kilometre | The length of 10 soccer/rugby fields |
| | $mm^2$ | | square millimetre<br>millimetre squared | |
| | $cm^2$ | | square centimetre<br>centimetre squared |  |
| | $m^2$ | | square metre<br>metre squared | Slightly more than the area of half a standard door |
| | $km^2$ | | square kilometre<br>kilometre squared | The area of 100 soccer/rugby fields (1000m x 1000m) |
| | ha | | hectare | The area of a soccer/rugby field (100m x 100m) |
| | | $cm^3$ | cubic centimetre<br>centimetre cubed |  |
| | | mℓ | millilitre | |
| | | $m^3$ | cubic metre<br>metre cubed | The volume of a big box - as high as half the height of a standard door with the same length and breadth (1m x 1m x 1m) |
| | | ℓ | litre | The volume of any 1 ℓ bottle |

1.3.2

| Units | |
|---|---|
| 25 mm | 2,5 cm |
| 20 000 $cm^2$ | 2 $m^2$ |
| 60 000 $mm^2$ | 600 $cm^2$ |
| 500 $cm^3$ or mℓ | 0,5ℓ |
| 1 500 m | 1,5 km |
| 12 000 $m^2$ | 1,2 ha |
| 3 000 $mm^2$ | 30 $cm^2$ |
| 2 000 ha | 20 $km^2$ |
| 75 cm | 0,75 m |
| 6 000 ℓ | 6 $m^3$ |



## Activity 1.4

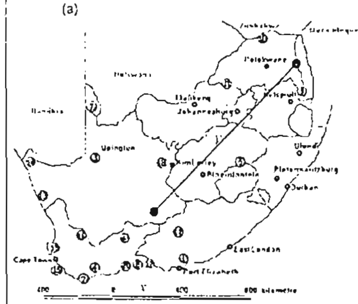
Individual

Recommended time: 30 min

Marks: 17

### Teacher assessment

Use the entrance to the Kruger National Park as indicated on the map.

| Act no | Possible answers | Mark allocation | M |
|---|---|---|---|
| 1.4.1 | (a)<br><br> | Plotting the school's position fairly correctly, i.e correct province, towards the east, west, north, south, etc. 1 mark<br>Measuring the distance, y, from the school to the gate accurately. 1 mark<br>Measuring the distance, x, on the scale correctly 1 mark<br>Calculating $\frac{y}{x} \times 400km$ = correctly 2 marks | |
| | (b) Estimation because<br>Location of school and gate is an estimate.<br>Roads do not follow straight lines. | 1 mark for each reason 2 marks | |
| 1.4.2 | No influence.<br>Both y as well as x will be 80% of the original size and therefore the ratio $\frac{y}{x}$ will remain the same | Correct answer 1 mark<br>Reason 2 marks | |
| 1.4.3 | Area = 350km x 60 km = 21 000 $km^2$ | Multiply two distances 1 mark<br>Correct answer 1 mark | 2 |
| 1.4.4 | 21 000 $km^2$ = (21 000 x 100) ha = 2 100 000 ha<br>The KNP is not a rectangle.<br>The two dimensions given are averages. | Correct answer 1 mark<br>1 mark for any appropriate reason 1 mark | 2 |
| 1.4.5 | Percentage increase.<br>$\frac{10\,000\,000}{2\,149\,700} \times 100 = 465,18\%$ | Converting one of the areas to the same unit as the other 1 mark<br>Dividing in the correct order 1 mark<br>Correct answer 1 mark | 3 |

## TASK 2 TOURING THE KRUGER NATIONAL PARK

Recommended time: 105min

Marks: 27

### Activity 2.1

Individual

Recommended time: 15 min

Marks: 5

**Peer assessment**

Discuss the financial implications of an educational tour with special regard to accommodation. Discuss 'base occupancy' and 'max beds' (Table 3)

| Act no | Possible answers | Mark allocation | Marks | |
|---|---|---|---|---|
| 2.1 | 18 Boys: 3 Camping units: (max 6 per unit)<br>Base occupancy 3xR100 = R300<br>Additional costs: 12xR35 = R420<br>Total: R720 | Correct number of camping units 1 mark<br>Correct cost for base occupancy 1 mark<br>Correct number of boys paying additional costs 1 mark<br>Correct costs for boys 1 mark | | |
| | 22 Girls. 6 Safari units 4 girls in 5 units and 2 in one unit<br>Base occupancy 6xR230 = R1380<br>Additional costs: 10xR70 = R 700<br>Total: R2080 | Correct number of safari units 1 mark<br>Correct base occupancy cost 1 mark<br>Correct number of girls paying additional costs 1 mark<br>Correct costs for girls 1 mark<br>Correct total cost 2 marks | | $\frac{10}{2}$ |
| | Total cost: R720 + R2080 = R2800 | | 10 | 5 |



### Activity 2.2

Groups

Recommended time: 20 min

Marks: 8

Teacher assessment

Discuss rates of change and how to conduct investigations with the learners.

| Act no | Possible answers | M |
|---|---|---|
| 2.2.1 | **Investigating the increase in rates:** | |

| Unit type | Tariffs | | | | |
|---|---|---|---|---|---|
| | 2004/05 | 2005/06 | Rate of change | Check | Rounded off |
| Camping | 100,00 | 105,00 | $\frac{105}{100}=1,05$ | 100x1,05=105 | 105 |
| Safari Tent – communal facilities | 230,00 | 240,00 | $\frac{240}{230}=1,043$ | 230x1,04=239,20 | 240 |
| Bungalow CK | 460,00 | 480,00 | $\frac{480}{460}=1,043$ | 460x1,04=478,40 | 480 |
| Bungalow K | 495,00 | 515,00 | $\frac{515}{495}=1,0404$ | 495x1,04=514,80 | 515 |
| Luxury Bungalow | 770,00 | 800,00 | $\frac{800}{770}=1,039$ | 770x1,04=800,80 | 800 |
| Luxury Riverside Bungalow | 885,00 | 920,00 | $\frac{920}{885}=1,0395$ | 885x1,04=920,40 | 920 |

**Conclusion:**

The tariffs increase by 4% per year, because

- rounded off all percentages except the first one amounts to a 4% increase
- if the tariffs are increased by 4% and the answers rounded off to the nearest R5, all 2005/2006 tariffs correspond with those on the list (Table 6).

**Marking rubric:**

| Component | Excellent | Achieved | Partly achieved | Not achieved |
|---|---|---|---|---|
| Calculations 4 marks | All calculations are correct and rounded to an appropriate number of decimals 4 marks | Most of the calculations are correct 3 marks | Two or three calculations are correct 2 marks | Effort to find increase full of mistakes 1 mark |
| Conclusion and motivation 4 marks | Derived at the correct percentage increase with full motivation 4 marks | Derived at the correct percentage increase with only one reason 3 marks | Derived at the correct percentage increase without motivation 2 marks | Could not make any conclusion 1 mark |
| Checking 4 marks | All tariffs have been checked and rounded off to the nearest R5 correctly 4 marks | Most of the tariffs have been checked and rounded off correctly 3 marks | Two or three tariffs have been checked and rounded off correctly 2 marks | Effort to check unsuccessful 1 mark |

$\frac{12}{2}$

2.2.2

| Unit type | Tariffs | | | |
|---|---|---|---|---|
| | 2004/05 | 2005/06 | | 2006/07 |
| Camping | 100,00 | 105,00 | 105x1,04=109,20 | 110,00 |
| Safari Tent – communal facilities | 230,00 | 240,00 | 240x1,04=249,60 | 250,00 |

### Activity 2.3

Recommended time: 40 min

Individual

Marks: 9

Individual

Discuss the relationship between speed, distance and time and how to convert hours to minutes and vice versa.

| Act no | Possible answers | Mark allocation | Marks | |
|---|---|---|---|---|
| 2.3.1 | Speed limit 50 km/h<br>Gates open: 06 C0<br>Distance from Skukuza to Lower Sabie 46 km<br>Travel time at 50 km/h: $\frac{46}{50} \times 60 = 55$ minutes<br>Time of arrival 06 55 | Speed limit correct 1 mark<br>Distance correct 1 mark<br>Calculating travel time correctly 2 marks<br>Correct arrival time 1 mark | 5 | |
| 2.3.2 a) | Any two appropriate reasons relating the purpose of driving through the KNP with variance in speed | One mark for each reason 2 marks | 2 | |
| 2.3.2 b) | Travel time at 20 km/h:<br>$\frac{46}{20} \times 60 = 138$ min = 2 hours and 18 min<br>OR 2,3 hours<br>Time of arrival: 08.18 | Correct rate 1 mark<br>Correct travel time 1 mark<br>Correct arrival time 1 mark | 3 | |
| 2.3.3 | Distance from Lower Sabie to Satara 93 km<br>Duration of trip from Lower Sabio to Satara: 6,5 hours<br>Average speed: $\frac{93km}{6,5h} = 14,3km/h$ | Distance correct 1 mark<br>Duration of trip correct 1 mark<br>Average speed correct 1 mark<br>Unit correct 1 mark | 4 | |
| 2.3.4 | Distance from Satara to Phalaborwa gate. 119km<br>Time spent on road<br>$\frac{119}{20} \times 60 = 357$ min $\approx 6 hours$<br>If they had left at 06:00 from Satara, they could have spent 33 minutes at Letaba | Distance correct 1 mark<br>Time spent on road correct 2 marks<br>Time spent in Letaba 1 mark | 4 | $\frac{18}{2}$<br>9 |



### Activity 2.4

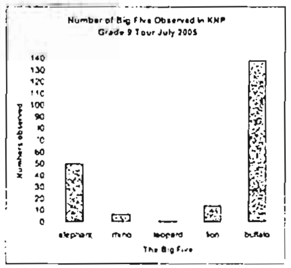
Recommended time: 30 min

Groups

Punte: 5

Group assessment

Learners should draw the graph on the grid paper provided in Annexure A. Let groups of fiv learners assess another group of five learners' responses. Provide each group with a copy this memorandum. The group should discuss each response according to the criteria provided and make a decision about the allocation of each mark.

| Act no | Possible answers | Mark allocation | M |
|---|---|---|---|
| 2.4.1 | Elephants 50<br>Rhinoceros 7<br>Leopard 1<br>Lion 14<br>Buffalo 138<br> | Suitable title for the graph 1 mark<br>Relevant names for the axes 2 marks<br>Scale chosen – accommodating all numbers proportionally 1 mark<br>Correct height of the bars – 1 mark each 5 marks<br>The general appearance of the presentation 1 mark | |
| 2.4.2 | Any feasible description of the numbers of animals they observed and possible reasons why | | |