An investigation into the benefits of integrating learners' prior everyday knowledge and experiences during teaching and learning of acids and bases in Grade 7: A case study

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By

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DECLARATION

I, the undersigned, hereby declare that the work contained in this dissertation is my own original work and has not previously in its entirety or in part been submitted at any university for a degree.

Signature: …….. Date: …….

ABSTRACT

This study was conducted at a school designated as a higher primary school comprised of grade 0-9 learners (GET band) in Grahamstown in the Eastern Cape, South Africa. With the advent of the new curriculum in South Africa, we are also grappling with the implementation of the new curriculum at this school. This motivated me to investigate the benefits of eliciting and integrating learners' prior everyday knowledge and experiences during teaching and learning of acids and bases. Essentially, the study sought to gain insight into whether engaging learners during practical activities using easily accessible materials from their homes facilitated meaning-making of acids and bases.

This study is located within an interpretive paradigm. Within this paradigm, a qualitative case study approach was conducted with the researcher's Grade 7 class. To gather data, document analysis, semi-structured interviews, questionnaires, lesson observations, stimulated recall discussions while watching the videotaped lessons as well as focus group interviews with learners were used. An inductive analysis to discover patterns and themes was applied during the data analysis process. The validation process was done through watching the videotaped lessons with the teachers who observed the lessons. Also, transcripts of the interviews and a summary of discussions were given back to the respondents to verify their responses and check for any misinterpretations.

Rich data sets were analysed in relation to the research questions which were: How do Natural Sciences teachers elicit and integrate learners' prioreveryday knowledge and experiences to facilitate learning of scientific concepts of acids and bases in their classrooms? Does engaging learners in practical activities using everyday substances enhance their conceptual development and understanding of acids and bases?

The findings from the study revealed that the use of learners' prior everyday knowledge and experiences during teaching and learning of acids and bases facilitated meaningful learning. Furthermore, linking learning to learners' everyday experiences enabled them to learn scientific concepts in a relaxed and non-threatening environment. It is thus recommended that teachers should be supported in their endeavours to incorporate learners' real life experiences during their teaching and learning repertoires. Notwithstanding, as much as there were benefits in this study there were, however, also some challenges that were encountered, such as language, which warrants further research.

DEDICATION

This thesis is dedicated to my husband (Ntsikelelo Kuhlane), my daughter (Nosithembiso Kuhlane) and my family.

They all care about my welfare and are very supportive of me.

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DoE –	Department of Education
DSG –	Development Support Group
EDO –	Education Department Official
GET –	General Education and Training Band
HDE –	Higher Diploma in Education
HL–	Home Language
IP -	Intermediate Phase
IQMS –	Integrated Quality System
LoLT –	Language of Learning and Teaching
LTSMs -	Learning and teaching support materials
OBE –	Outcomes Based Education
PEEOE –	Predict, Explain, Explore, Observe, Explain
POE –	Predict, Observe Explain
RNCS –	Revised National Curriculum Statement
SP -	Senior Phase
ZPD -	Zone of Proximal Development

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CHAPTER ONE

SCOPE OF RESEARCH

1.1 Introduction

This chapter introduces the study by presentingitsrationale and the context. It also presents the focus of the study by outlining the research goal and the research questions based on this study. The curricula issues based on teaching of the Natural Sciences curriculum (GET-GRADE 7-9) arealso explored and analysed.

Finally, my assumptions upon which the research study was based on as well as an overview of the thesis are presented through a brief summary of each of the chapters.

1.2 Motivation for the study

This research on the use of prior everyday knowledge and experiences of learners in the teaching of acids and bases in a Grade 7 class, was prompted by the fact that as a grade 7-9 NaturalSciences teacher I observed and noticed that there is a great demand for knowledge in chemical reactions of acids and bases from Grade 9 learners. From this observation there was something puzzling, for example, although there isagreat demandfor knowledge in chemical reactions of acids fromGrade 9 learners, I noticed that learners usually had no prior content knowledge based onlearning acids and bases from the previous grades.

Moreover, analysing the Natural Sciences curriculum (DoE, 2009) for General Education and Training(GET) Band, acids and bases are only mentioned inGrade 9 where the syllabus focuses more on compounds, mixtures and chemical reactions of acids and bases. This is where I was confused because in Grade 7 it is mentioned that classification of substances should be done. Yet, it is not clear what or which substances must be used.

In my view,the development of concepts and basic scientific knowledge in this topic of acids and bases is necessary and important. This motivated me to investigate the benefits of

teaching acids and bases using everyday materials in Grade 7 which I assumed could result in greater benefits in terms of meaningful learning for both teachers and learners.

Perhapsa question that could be posed could be, why this kind of investigation? Firstly, my assumption was that this would help learners understand and familiarize themselves with concepts in acids and bases. Secondly, learners would be able to learn how to handle chemicals (safety rules) in the classroom since the resources were not dangerous or harmful, and more importantly the resources would be easily accessible and familiar to the learners' real lives (Oloruntegbe & Ikpe, 2011; Rennie, 2011).

Furthermore, since most township schools are not well-resourced and yet the science curriculum motivates teachers to consider the daily experiences of learners when teaching, I then saw an opportunity for this investigation where learners would bring different substances such as *Handy Andy*, *Sunlight liquid soap*and so forth from their homes. Not only could this topicbe taught in Grade 7 but it could then continue to Grade 8 where refined scientific concepts based on acids and bases could be introduced in order to prepare learners for Grade 9 lessons in chemical reactions of acids and bases.

It is understandable, though, that the results or the testing of substances from these daily resources might not be as perfect as it could be when using the laboratory resources but at least learners would be able to group and classify substances according to the colour changes and the way these substances react.

1.3 The curriculum issues

The Constitution of the Republic of South Africa (Act 108 of 1996) provides the basis for the curriculum transformation and development in South Africa (South Africa, Department of Education (DoE), 2002). One of the aims of the South African Constitution is to lay the foundations for a democratic and open society in which the government is based on the will of the people and to improve the quality of life of all citizens and free the potential of each person (DoE, 2002). Following from this view, it is evident that education, in particular, the curriculum, has an important role to play in realising the aims of the South African Constitution. It is for this reason that the curriculum aims at developing the full potential of each learner as a citizen of a democratic South Africa.

From this perspective, the curriculum has been shifted from the traditional approach in which the curriculum was content-based and teacher-centred to one in which the curriculum focuses on knowledge, skills values and attitude and is learner-centred (DoE, 2002; Van Harmelen, 2003; Hobden, 2005). During teaching and learning processes the learner-centred approach emphasizes that learners should be active participants rather than being passive participants (Moll, 2002: 6). This change in approach to teaching and learning has been propagated in all the learning areas across the curriculum.

Nevertheless, since the introduction of Curriculum 2005 (C2005) there have been many arguments on how to approach teaching and learning activities in schools. For example, the Natural Sciences Learning Area is one of the learning areas in which these arguments have raised concerns on how teachers should approach it since the new curriculum involves the development of a range of process skills that may be used in everyday life (DoE, 2002). This is by and large evident in the way in which the Natural Sciences Curriculum has been structured.

For instance, the three learning outcomes, which are scientific investigations, constructing science knowledge and science society and the environment, demand both teachers and learners to actively interact with the world in which they live during the process of teaching and learning. Millar (2004) argues further by saying that scientific knowledge is something that provides material explanations for the behaviour of the material world and their properties. Millar's view about science resonates with the South African Curriculum in one way or another as the South African Curriculum also refers to science as the world in which we live.

However, Hodson and Hodson (1998: 34) argue that learning science is not simply a matter of making sense of the world in whatever terms and for whatever reasons satisfy the learner. Rather, learning science involves introduction into the world of concepts, ideas, understandings and theories that scientists have developed and accumulated. From this school of thought, it is clear that although learners have some knowledge from their experiences, they also need guidance and scaffolding from teachers in order to develop scientific knowledge.

Furthermore, in order for learners to develop scientific knowledge they need to be introduced to new experiences so as to be able to assimilate between everyday knowledge and real scientific knowledge. That is, learners can be able to develop skills to acquire more scientific knowledge while working with everyday experiences. This suggests that learners will continuously assess how each activity or experience is helping them gain an understanding of science.

Hodson (1996: 756) too confirms that, in any scientific enquiry, students achieve three kinds of learning. Primarily, conceptual understanding of whatever is being studied or investigated is enhanced. Secondly, they will enhance procedural knowledge – learning more about experiments, acquiring a more sophisticated understanding of observation, experiment and theory. Lastly, they will enhance investigative expertise.

It is precisely for these reasons thatit has been argued that it is very important to consider learners' experiences when teaching science. To my understanding these experiences can form part of learners' prior everyday knowledge and experiences, that is, the knowledge they come with in class. Moreover, as mentioned above everyday knowledge can be constructed individually and socially. Hence this brings me to the importance and focus of this study.

1.4 Research focus

The main goal of this study was to investigate the benefits of eliciting and integrating learners' prior everyday knowledge and experiences during teaching and learning of acids and bases in Grade 7 with the view to enhance conceptual development, sense-making and hence understanding in this topic. The assumption of my goal was that, using everyday substances when teaching acids and bases could enhance learners' scientific knowledge in a non-threatening environment.

My initial goal was thus to elicit learners' prior everyday knowledge and experiences of acids and bases using aquestionnaire (Appendix E) of substances learners might use at home, for example, in the kitchen and in the bathroom.

Secondly, learners had to report and discuss with each other in their respective groups on how they each use these substances in their homes. In this part of the activity learners were collaboratively extending their knowledge about the different materials used at their homes.

Each group had to share their knowledge and findings on these substances with the rest of the class using poster presentations. The above activities helped me to find out which of the given substances learners were familiar with and how much they knew about them in their homes.

The actual teaching of acids and bases using the everyday resources has helped me to gain an insight into what arguments and discussions took place during this process and how far a teacher could use this kind of material to teach scientific concepts in acids and bases. With the help of participant observers this was a great success as they were not biased during reflection of this process. I believe too that the experience was of mutual benefit to both learners and teachers involved.

1.5 Research Questions

To realise the above goal Iendeavoured to answer the following questions:

- Does the socio-cultural background of learners influence their prior everyday knowledge and experiences of acids and bases?

- Does elicitation and integration of learners' prior everyday knowledge and experiences facilitate or constrain learning of scientific concepts on acids and bases?

- Does engaging learners in practical activities using everyday substances enhance or constrain their conceptual development and understanding of acids and bases?

1.6 Assumptions based on this study

Although learners have some prior everyday knowledge and experiences, they might not know how important that knowledge and experience is in enhancing their scientific knowledge. Thus, it could be argued that not all experiences are genuinely educative.

Nonetheless, I believe that the socio-economic background of learners does inform learners' everyday knowledge. According to Odora-Hoppers (2001) and O' Donoghue, Lotz-Sisitka,

Asofo-Adjei, Kota and Hanisi (2007), learners' experiences and surroundings can inform what they come with in class arguing that meaning-making interactions are critical in diverse socio-cultural learning contexts. Yet, from my experience some educators take everyday chemicals used at home for granted when it comes to teaching of acids and bases.

1.7 Significance or potential value of the study

This study will hopefully improve and strengthen working relationships amongst teachers and also improve learners' scientific understanding of acids and bases. Also, this study has the potential to raise learners' curiosity about their everyday experiences and their relevance to science as proposed by Stears, Malcolm and Kowlas (2003).

Furthermore, I hope that this study will promote the use of everyday substances as the learning and teaching support materials (LTSMs) (Czerniewicz, Murray & Probyn, 2000) whereby textbooks could henceforth be used as references rather than as sole sources of knowledge. Even in those schools where there are no laboratories and science equipment I believe they certainly can learn from this study that science can be taught meaningfully using everyday easily accessible resources.

Personally, I see this study as a form of capacity building and empowerment on my part and that of the two teachers who were participant observers and critical friends during this process. Finally, my study too might serve as a learning experience for Natural Sciences teachers on how to collaborate while grappling with context-based learning.

1.8 Overview of chapters

Chapter 1:

This chapter gives the outline of the research, the background of the research, the significance or potential value of the study andthe assumptions based on this study. Finally, the researchfocus as well as research questions are also explained in this chapter.

Chapter 2:

This chapter engages with the literature related to the research topic. Literature related to prior everyday knowledge of learners, practical activities, andconceptual changes is discussed. Theoretical underpinnings, namely, constructivism, in particular,cognitive and social constructivism and the socio-cultural perspective are also discussed in this chapter.

Chapter 3:

This chapter looks at the research design, methodology and the research techniques employed in this study. For this study, document analysis, semi-structured interviews, questionnaires, observations, stimulated recall discussions and focus group interviews are thoroughly discussed with reference to how each technique was used to gather data. Analysis of data as well as issues pertaining to ethics and validity are also discussed in this chapter.

Chapter 4:

This chapter presents the findings and analysis of the data gathered from the various research techniques used. The data from interviews, document analysis and questionnaires (learner profile & prior everyday knowledge of learners) is presented with the use of examples from the data. The emerging concerns from lesson observations and teacher' discussions with the two participant observers are also presented with some direct examples from these techniques.

Chapter 5:

Using the literature reviewed, this chapter deals with discussions of the findings and the themes that emerged in this study. The analysis of results from Chapter 4 is discussed with reference to the findings and themes that emerged from this study.

Chapter 6:

In this chapter, the journey, my reflections throughout this process and the experiences gained from this research are presented. In addition, this chapter presents evaluation, limitations as well as some recommendations for further research. This chapter concludes with a final conclusion based on this study.

1.9 Conclusion

This chapter presented the research background and the potential value of the study. The research focus, assumptions upon which the research is based together with the curriculum issues are outlined and discussed in this chapter as well. The short summary of each chapter is also presented to guide the reader.

The next chapter discusses the literature based on this study, the theoretical framework informing this study and the importance of acids and bases are also discussed.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter explores the theoretical underpinnings of teaching andlearning in constructivist and social constructivist ways. Also, socio-cultural issues are discussed with reference to how prior everyday knowledge and experiences of learners enable or constrain learning.

Furthermore, the concept of prior knowledge and the development of concepts are explored as well. Also, the implications of practical activities in teaching of acids and bases are discussed.

Lastly, the different types of studies done based on teaching acids and bases are briefly explored.

2.2 Selected theories of learning in this study

This study is informed by the constructivist perspective**.** The Department of Education (2004) describes constructivism as being a theory based on observation and scientific study about how people individually and collectively learn. It then argues further by clarifying that people construct their own knowledge and understanding of the world through experiences.

Drawing from the work of Vygotsky (1986), Gagnon and Collay (2000) describe constructivism as the notion that learning is a social experience: individual thinking alone occurring first, and then testing that thinking in dialogue with others to construct shared meaning. Jarvis, Holford and Griffin (2003) also examined the most influential work of the two theorists Piaget and Vygotsky as they looked at how people learn.

Piaget observed how individual children grow cognitively in their developmental stages of growth. For Piaget (cited in Jarvis et al., 2003:33), as children grow older so too do their abilities to conceptualize knowledge grow. Piaget displays children's developmental stages as follows:

Period	Age (in years)	Characteristics
Sensory-motor	0-2	Infant learns to differentiate between self and objects in external world.
Pre-operational thought	2-4	Child egocentric but classifies objects by single salient features.
Intuitive	4-7	Child thinks in classificatory way but may be unaware of classification.
Concrete operations	7-11	Child able to use logical operations such as reversibility, classification and serialization.
Formal operations	11-15	Trial steps towards abstract conceptualization occur.

Table 1: Children's developmental stages: (Jarvis et al., 2003:33).

From the above theory of learning, there have been many arguments about how Piaget observed children as if they were independently realizing all the above things. Secondly, there has been an argument about the age group he looked at. Hence, Vygotsky decided to expand on Piaget's theory (Jarvis et al., 2003: 36).

Vygotsky (1978) saw the missing part from Piaget's theory and he suggested that, from Piaget's theory the reality and relations between a child and reality are missing. He then determined two different developmental levels: the actual developmental level and the zone of proximal development (ZPD).

The actual developmental level: This is the level of a child's mental functions as a result of developmental cycles which have already been completed.

The zone of proximal development: This is the distance between the actual developmental level as determined by independent problem-solving of an individual and the level of potential development as determined through problem-solving under adult guidance or in collaboration with more capable peers Vygotsky (1978) as cited in (Jarvis et al., 2003:37).

However, from the above theorists it is clear that either way, as humans we learn and experience things individually at first but the maximum level of our mental development is beyond reach when we work collaboratively with others. If people construct knowledge through experiences, it is for this reason that prior everyday knowledge and experiences should be one of the strategies that could be used in teaching and learning of science.

From my understanding the above theories suggest that people can construct knowledge from the surroundings: from home, churches, culturally and politically. Drawing from the above issues two strands of constructivism will be discussed, namely: cognitive constructivism and social constructivism.

2.2.1 Cognitive Constructivism

Cognitive constructivism is based on how individuals learn as they grow or develop. Learners have different learning styles and developmental stages hence they understand things individually and differently. This is traced back to the work of Piaget who demonstrated that the minds of learners are not empty. Instead, learners are actively involved in the material which is presented (Atherton, 2009). This is one of the critical aspects in the teaching and learning processes where learners differ in their ability to understand the subject at hand. Yet sadly some teachers tend not to cater for all learners in their planning.

Arguing from the above viewpoint, it is noted that children come to school with different beliefs and cultures even if they are from the same socio-cultural background. Children tend to look at things differently and at different times or stages. For example, in the context of this study children from rural areas might have different experiences of acids and bases compared to children from urban areas. However, through sharing views and ideas from their experiences, learners can help each other understand things better in the classroom and even come up with new ideas. Drawing from the above, social constructivism will be discussed.

2.2.2 Social Constructivism

Social constructivism is described as knowledge that is constructed socially by human beings in working with one another (Janse van Rensburg & Lotz-Sisitka, 2000:12). As alluded to above (section 2.2.1), learners from the same society can come to class with different knowledge when working together so they might learn from each other and can even develop an understanding of new knowledge.

For example, in this study learners are assumed to have their individual knowledge on how each of the substances (home materials on acids and bases) is used in their homes.Thus, through discussions and presentations that will take place in the classroom their knowledge based on these substances will develop. It is for these reasons that I see social constructivism theory as important and relevant in my study.

> Recently the Department of Education in South Africa has advocated a number of features of a constructivist classroom as the basis of the paradigm shift from the old approach in the classroom associated with apartheid education to the learner-centred approach associated with transformational OBE (Moll, 2002: 6).

One of the unique features of the learner-centred approach is that learners are encouraged to work in groups or behelped by an adult as it is believed that knowledge is socially constructed (O'Donoghue et al., 2007) through sharing views and ideas. Moreover,learners are seen as critical thinkers especially if positive opportunities are presented to them.

What does this mean? It means that learners need to be directed in a correct destination.In terms of the classroom environment, learners should be allowed to work and interact freely. Teachers should also be equipped with skills to create these opportunities for learners. For example, teachers should be able to bring appropriate materials into classrooms and be able to develop challenging activities for learners.

In social constructivism, emphasis is on the meaning and understanding which comes out of social interactions (McRobbie & Tobin, 1997). Although the promotion of learners working together is encouraged what comes out of such activities is even more important. I think the following questions are important when teachers are to participate in such activities: Are learners going to learn anything from this activity? Are the discussions or activities on social learning going to help learners (O'Donoghue et al., 2007) ?

Vygotsky (1978) in his theory of the zone proximal development (ZPD) observed that when learners were assessed on tasks in which they worked independently they did not do as well as they did when they worked in collaboration with others. This is because when learners work in collaboration with others they enter another level of discussions and arguments, which could lead to them making meaning of their learning processes anddevelop more appropriate knowledge. Hence, when working with others, learners' understanding of the subject at hand can be stretched beyond their previous individual understanding.

Next I will outline the benefits of constructivism as a learning theory.

2.2.3 The benefits of constructivism as a learning theory

According to the Department of Education (2004), children learn more and enjoy learning when they are actively involved, rather than by being passive listeners. Constructivism thus concentrates on learning how to think and understand rather than on memorisation. Furthermore, in constructivism learning is transferable; meaning that in constructivist classrooms learners create organising principles that they can take with them to other learning settings. Moreover, constructivism gives students ownership of what they learn, since learning is based on students' questions and explorations. For this reason, I will thus look at socio-cultural issues and everyday experiences as they also inform the prior everyday knowledge of learners.

2.3 Socio-cultural issues and learning experiences

Experience is defined in different ways by different people. Jarvis et al. (2003:54) define experience as something subjective and a form of thought, but those thoughts are constructed and influenced both by our biography and by the social cultural conditions within which they occur. On the other hand, Beard and Wilson (2006:2) describe experience as something that pervades all forms of learning and its value is frequently not recognised or even disregarded. This suggests that an experience is a source of knowledge and therefore to construct knowledge an individual has to experience something.

Drawing from the above definitions, an experience can be something direct; a feeling; knowledge; an impact of an external phenomenon; life history (can be cultural as well) and it can be an emotional moment.

In this study learners are assumed to have experienced working with or using substances such as soap, dish-washing liquid, bicarbonate of soda, vinegar, *Colgate*, etcetera. If learners are not familiar with these substances it is of interest to hear or see what other substances they might be familiar with. This suggests that learners are either using these substances in their homes or have seen their parents using them; which is why 'experiential learning' informs this study as well. In my view, experiential learning canequally contribute to everyday knowledge and science knowledge. As stated by Beard and Wilson (2006), experience is a significant engagement with the environment in which we use our previous knowledge to bring new meanings to interaction.

From the above, experience is seen as the foundation of, and the stimulus for learning. Learners will actively construct their own experience either from home or from their surroundings (Jarvis et al., 2003:56). Here learners' prior experiences play a vital role in the socio-cultural processes of knowledge construction. These experiences are used as learners share their experiences and insights. That is, meaning-making occurs when learners share their knowledge during participatory processes during well-organised activities.

Traianou (2006: 835) states that from "a social perspective an individual's understanding of concepts, theories, and ideas of particular community is a dynamic process resulting from acting in situations and from negotiating with other members of that community". She further explains that such understanding is constructed first on a social plane before it becomes internalised by an individual. Furthermore, it is best described as an evolving spiral; in which lower mental functions and higher mental functions develop interdependently as individuals participate in socially and culturally organised activities. In that way knowledge is developed.

Apart from offering a different perspective about knowledge and how it develops, socio-cultural theory also carries particular implications about learning and expertise. It suggests that learning involves "enculturation of novices into practices of a particular community where they learn through cognitive apprenticeship its language, and other cultural patterns of communication" (Traianou, 2006: 836).

In this study learners' prior everyday knowledge was assessed with a view to get to know what materials (acids and bases) they use at home. According to the above theorists (Beard & Wilson, 2006; Jarvis et al., 2003; Traianou, 2006), knowledge and understanding of human

beings can be viewed by what they have already developed on their own with the help of their surroundings. That individual knowledge and understanding can be supplemented when the individuals interact with others. In science learning and teaching, there is a great deal on how teachers can shift learners' conceptual understanding from the contextual view to scientific concepts.

The next section will thus look at the concept of prior everyday knowledge based on this study. My assumption is that in science it is very important to clarify concepts so as to make sure that learners do not confuse or misunderstand them.

2.4 The concept of prior (everyday) knowledge

Roschelle (1995) defines prior knowledge as the learning experience that forces a theoretical shift to viewing of learning as a 'conceptual change'. He argues further by saying that it is impossible to learn without prior knowledge. Essentially, prior knowledge can be viewed from two perspectives, that of the accomplished scientist or that of the learner. Firstly, there are everyday experiences or practises by learners from their societies that are scientifically based and secondly there are scientific processes and methods accomplished by scientists.

From the above perspective, it could be argued that learners come to class with different understandings and knowledge bases gained from different experiences. It is such knowledge and experiences that could help learners inform new ideas during learning processes. Hence it is important for teachers to evaluate this knowledge and these experiences by trying out different ideas and reflecting on their values, so thatsuch knowledge could be beneficial to learners. It is for this reason that the Natural Sciences curriculum statement Grade 7-9 (DoE, 2002) emphasizes the need for teachers to integrate their lessons with the everyday knowledge and experiences of learners since this strategy is assumed to ease the learners' minds when learning science.

Also, to help learners make the most of new experiences, educators need to understand how prior knowledge affects learning (Roschelle, 1995). In this case teachers need to design tasks that will enable learners to gradually develop new scientific concepts and make connections between the 'old' and the 'new' knowledge while effectively being involved with tasks. This means that teachers need to have different strategies to work with learners as they come with various experiences.

Since there is an assumption that science is something that we deal with in our everyday life, it is very important for teachers to have ways of allowing learners to share and discuss their everyday experiences and link them with the science content knowledge. “The learner is encouraged to investigate the world to find out about it with others, and engage in collaborative reflections and change-orientated actions” (Wessa/Sharenet, 2006: 28).

The use of everyday materials in this study enabled learners to further explore things that they use at their homes, in their societies as well as to develop scientific knowledge about these substances. Oloruntegbe and Ikpe (2011: 268) argue that students are not encouraged to see the connection between science learned in schools and the house hold chores they engage in at home in the framework of content base learning. Hence this study attempts to examine the benefits of connecting the above two aspects. On the other hand, Millar (2004) explains the distinctive characteristics of scientific knowledge as being that which provides material explanations for the behaviour of the material world and their properties.

Furthermore, as highlighted in section 2.3, learners’ experiences can develop their knowledge and frequently those experiences are not recognised or even disregarded (Beard & Wilson, 2006: 2). For example, in this study teachers and learners worked with everyday materials sincemost learners do experience many things at their homes about acids and bases but do not take them into consideration. One of the reasons for this could be that teachers tend to drive the students along to cover the overburdened syllabus in preparation for tests (Oloruntegbe & Ikpe, 2011).

Beard and Wilson (2006) also argue that everyday learning can be constructed in a variety of ways, such as learning via television, learning from adults and asking questions about why we do certain things the way we do them. The challenge for many teachers, however,could be how to elicit and integrate prior everyday knowledge of learners in their teaching. More importantly, in science especially chemistry, most topics are related with what happens around communities and therefore if teachers also have limited prior knowledge about certain aspects they will ignore them. And this will impact negatively on their learners’ conceptual understanding.

For example, with regard to acids and bases, if there are certain substances that a teacher does not knowthe likelihood is that the teacher will avoid talking about those substances unless

learners bring them up. But even then the explanations based on those substances might be partially or superficially explored. Thus, it is very important for teachers to elicit and integrate their learners' prior everyday knowledge so as to make their lessons effective and meaningful to their learners.

This argument brings us to the next discussion of the study, incorporating everyday experiences (prior everyday knowledge) when teaching acids and bases and the processes involved in practical activities.

2.5 The importance of practical activities in science classrooms

In this study, practical activities were the key component as learners conducted these using everyday resources. Swain, Monk and Johnson (1999) argue that practical activities provide students with insights of the natural world. My opinion on thismatter is that, if practical work is to provide students with the behaviours of the natural world, that all depends on how teachers and learners perceive these activities and how they conduct them in the learning situation.

Millar (2004) also argues that the effectiveness of practical work refers to the link labelled, that is practical activities should have a purpose attached to them. The following question could be asked in order to verify the purpose of the practical task: do students learn what is intended for them to learn? Again, the task itself must be designed effectively so that learners could be able to develop various skills as science is characterised as the product, a process and an enterprise (Millar, 2004).

Maselwa and Ngcoza (2003) too identified that most learners do enjoy practical activities in their classrooms especially if they are carefully planned with a focus on identification and development of key scientific concepts. They also suggested that practical activities can promote learners' conceptual understanding through discussions and conceptual maps.

Following from this, I too believe that practical activities should also allow elicitation and integration of prior everyday knowledge for learners to be able make connections between their existing and the new knowledge. If learners are to enjoy practical activities it is for this reason that the importance of my study comes in, eliciting and integrating prior everyday

knowledge, and experiences of learners will not only make them enjoy science but also promote curiosity about the matters around them.

Hodson (1990) argues further that in the contemporary world, almost all major science curriculum developments of the 1960s and early 1970s have promoted hands-on practical work as an enjoyable and effective form of learning. Implementing practical work in science classes can result in knowledge and skills improvement of learners or result in disappointment for some learners. Hodson (1990) also agrees that practical work can be an enjoyable form of learning. In my view, practical activities should not only be about enjoyment, but they should promote learners' scientific understanding, and hence there are strong arguments for and against practical work.

2.5.1 Strengths and weaknesses of practical activities in science

Strengths of practical activities

The purpose of practical work in science teaching is to develop cognitive knowledge, effectiveness and skills. From this, the question is what is meant by cognitive knowledge? What is meant by effective practical work? And what type of skills?

Cognitive knowledge is when practical work improves learners' understanding of science and helps confirm theory (Peers, Diezmann, & Watters, 2003). Effectiveness and skills development is based on 'hands-on', 'minds-on' and 'words-on' practical activities as proposed by Maselwa and Ngcoza (2003). However, when it comes to skills development, students can develop various skills such as observation, measuring, predicting, inferring and evaluation (processing). This complements the view that science is characterised as a product, a process and an enterprise (Millar, 2004).

According to Swain, Monk and Johnson (1999), practical work helps learners to find facts and arrive at new principles. It helps to develop creative thinking and verify facts and principles thatare already taught. Hence, Millar (2004) defines practical work as any teaching and learning activity which involves the students at some point observing or manipulating real objects and materials. However, the above theorists clarify that learners' involvement is crucial during practical activities. It is for this reason that practical tasks should allow learners to take an active role in taking on the new knowledge and students have to make sense of the experiences and discourses.

There is an assumption that learners come to class with some knowledge and if so I believe that learners should be given opportunities to explore that knowledge. This could improve their understanding of scientific concepts while on the other hand learners relate, connect to and grasp new knowledge. Therefore, the way teachers conduct practical activities in their classes is crucial. It is thus proposed that science teachers should not only focuson the results of the activity but should rather focus on the learning processes as well. Woodley (2009:50) summarizes the importance of practical activities as follows:

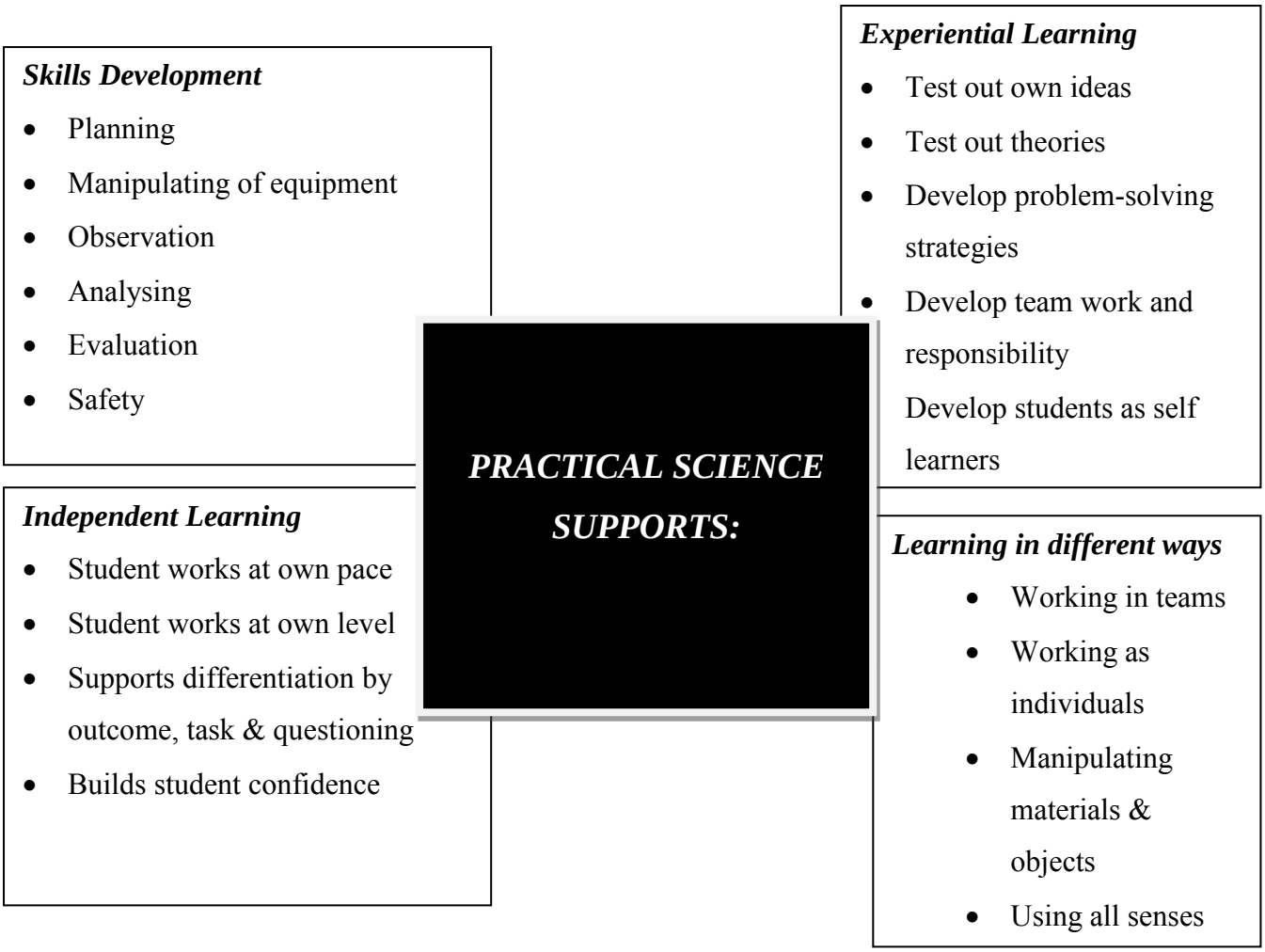


Figure 1: Woodley (2009: 50)

Drawing from this figure or summary (Woodley, 2009: 50), it is clear that if practical activities are planned and organised well the outcomes can be very rewarding. Consequently, when planning practical activities they need to be thought out and at the same time teachers need to consider their learners' abilities and weaknesses in order to avoid misconceptions that may surface. Thus, following from these views weaknesses of practical activities are discussed.

Weaknesses of practical activities

Hodson (1990) argues that practical work, as conducted in many schools, is ill-conceived, confused and unproductive. That is, it provides little educational value. For many children, what goes on in the laboratory contributes little to their learning of science or to their learning about science. Following from this view, Swain, Monk and John (1999) listed some of the reasons why practical work could be confusing for some learners. They found out that due to lack of proper planning, lack of resources and large numbers of learners in class, practical activities can be ineffective.

Furthermore, Hodson (1990) argues that some teachers have different perceptions about practical work and they use it unthinkingly. He also argues further saying that if this kind of activity is to motivate learners, to teach laboratory skills, enhance learning andto develop certain scientific skills, it is very important to look critically at those claims, as not all learners are interested in the same things. Some views suggest thatif the nature of practical activities is not clearly explained, learners can be confused about approaches of scientific enquiry. Also, it is highlighted that there should be a relationship between theory and practical activities done (Hodson, 1990) and this leads to how teachers can improve practical activities in our classes.

2.5.2 Making practical activities a better learning experience for learners

According to Ramsden (1994), the science curriculum materials and activities should incorporate the following criteria: start from personal experience; include activities which emphasize that science is a human activity; provide examples of the caring applications of science; provide opportunities to discuss and explore opinions which relate to social issues; utilize teaching approaches which enable students to test their own ideas; provide opportunities for pupils to use more personal and expressive language; and relate physical science principles to the human body.

In addition to this, enabling learners to autonomously steer the course of practical work requires complex role changes for both teachers and learners. Practical work redistributes the responsibility of learning to students in order for them to become active participants in the construction of their own understanding of scientific phenomena (Zion & Slezak, 2005). Following from this statement, a practical activity could be more effective when learners and teachers:

- Know and understand why they are doing the particular activity. When learners relate to the activity, having some personal background enlightens them about the activity. This means teachers have to start from the known (experiences of learners) to the unknown (more complex);
- Having feedbackfromlearners is one of the opportunities for as a teacher to see how learners have understood the practical activity and how you can improve in the next activity. This can be done in different ways: discussions allowing learners to speak freely, asking questions and conducting interviews;

- Using daily examples especially the things they deal with almost everyday is a great opportunity for learners to compare their new knowledge with the existing knowledge;

- Doing all these activities and processes with learners can lead to an effective way of doing practical work and being able to assimilate scientific knowledge;

- Furthermore, being able to ask the right questions at the right time is important. This means that teachers must ask questions that are linked to the activity and questions that will permit learners to develop critical thinking; and

- In the absence of the equipment, teachers must improvise, try to use what they have and even ask help from other teachers**.**

2.6 Acids and Bases

During this study most of the literature I have read demonstrates an enormous concernfor learners' conceptions in chemistry. Most of such work exposes the nature of learners'knowledge, perceptions and misconceptions held in many topics in chemistry. Recently it hasbeen detected that most learners have difficulties in understanding 'reactions of acids and bases' andbalancing of equations in Grade 9 (DoE, 2009).

Modisenyane, Rollnick and Huddle (2004) conducted an action research on improving the teaching of acids and bases. Due to the recent changes by the Department of Education (DoE, 2003) they looked at the essential role of the teacher in the classroom. Their motivation was to find out how reflective practice as a strategy helped them to teach for conceptual change (Modisenyane et al., 2004). The main aims of their study were as follows: to examine the evolutionof theresearch process and how the researcher as a teacher was able to overcome some of the problems he encountered; and to explore how the research contributed to the researchers' ownunderstanding of his science teaching and learning (Modisenyane et al., 2004).

The findings of their research highlighted the following: through their analysis six themes were generated. The roles of the researcher and the students, the role of the researcherand the classteacher, using students' views, questioning style, group work, recall of prior knowledge and the use of particulate model of mater (Modisenyane et al., 2004).

Drawing from the above research, it is clear that learners' prior knowledge is important when teaching science. However, from their study (Modisenyane et al., 2004) the researchers did

not clarify as to which prior knowledge they were referring to. My question would be were they referring to the learners' prior everyday knowledge or to the learners' previous grade scientific knowledge? For example, in my study, I had incorporated learners' everyday knowledge and their experiences of acids and bases to enhance their conceptual development and understanding during teaching and learning of acids and bases. In doing so, learners could explore these daily substances by further comparing them even after this study.

Another research done on acids and bases was based on ideas and process skills used by South African and Norwegian students to perform cognitive tasks on acids, bases and magnetism. This research looked at learners' ideas about acids and bases as well as learners' ideas on magnetism (Ogunniyi & Mikalsen, 2004). The researchers in their study used twotypes of assessment instruments namely "My Ideas about Acids and Bases" (MIAB) and "My Ideas about Magnetism" (MIAM). The two main questions in their study were: what ideas about acid, bases and magnetism do South African and Norwegian students hold; secondly what process skills are evident in their responses to cognitive tasks on acids, bases and magnetism.

The findings of the above study were as follows: generally the students from both countries, although familiar with the substances used in this study (everyday substances like vinegar, *Handy Andy* cleaner *etcetera*) could not know their specific scientific attributes except as a result of teaching or investigation (Ogunniyi & Mikalsen, 2004). The overall findings showed that only 54% of South Africans and 29% of Norwegians were able to group the substances into appropriate categories.

Drawing from the above research, it could be argued that learners have different experiences hence different results (Ogunniyi & Mikalsen, 2004). Moreover, this research even mentions that in the previous study done by Ogunniyi (1999a) cited in (Ogunniyi & Mikalsen, 2004) the results showed that from the 95 students selected randomly 80% were familiar with acids and bases. This shows that if learners could be moved from their own conceptual understanding and their misconceptions cleared appropriately, science would be no mystery to them. Again, this study by Ogunniyi and Mikalsen (2004) promotes the use of learners' everyday knowledge in science classrooms.

It clearly identifies the importance and the need for teachers to consider learners' experiences when teaching. With the use of different strategies (of which some are suggested in this study)

challenges that face science teachers could be overcome. Likewise, Lin and Chiu(2007) in their research explored the characteristics and diverse sources of students' mental models of acids and bases.

As said already, all these studies reveal that during teaching and learning learners should be at the centre of learning. Meaning that in order to plan effectively teachers should know and understand their learners. These studies also highlight that if taught well 'acids and bases' could be a great topic for introducing learners to chemistry.

2.7 Conclusion

Although the main aim of this study was to look at how learners develop and construct knowledge, it was highly important to recognise the learning theories based on constructivism, social constructivism and socio-cultural issues since they inform this study. These learning theories give an insight on how prior knowledge can be developed by individuals. Hence, the intention was to investigate the benefits of eliciting and integrating learners' prior everyday knowledge and experiences during teaching and learning of acids and bases.

This chapter has looked at the above theories, the concept of prior knowledge, and the importance of practical activities during teaching and learning of acids and bases. Studies that highlighted the importance of teaching acids and bases using prior knowledge of learners have been explored in this chapter. These studies and theories gave me an insight on how to overcome challenges and how to go about using the interventions I intended to use in this study appropriately.

In Chapter 3, the methodology of the research process and the methods used to gather data in this study are discussed.

CHAPTER THREE

METHODOLOGY

3.1 Introduction

This chapter explains the steps that were taken during this research process. These include the explanation as to why the case study or the classroom research was chosen for this study. The qualitative approach, the research paradigm that underpins this study, is also discussed. The pilot study and the sampling of the participants in this study are also discussed starting with the profile of the researcher. Ethical issues as well as validation are considered in this chapter.

The selected methods for data generation are described, namely: document analysis; semi-structured interviews; questionnaires; lesson observations; focus group interviews and stimulated recall discussions that were informed by lesson observationsand videotaped lessons.

The data generation techniques were clustered into different phases for this study.

Phase 1: Document analysis (twoGrade 7 textbooks and NCS document for Natural Sciences grades 7-9)

Phase 2: Interviews with two teachers (the intermediate and the senior phase teacher)

Phase 3: Questionnaires for learners: (leaner profile and elicitation of learners' prior everyday knowledge). Phases 1 to 3 formed the baseline data for this study.

Phase 4: Lesson observation (lessons on teaching acids and bases in Grade 7)

Phase 5: Focus group interviews with learners and stimulated recall discussions from lesson observations with the teacher who did the observations. Phases 4 and 5 were the main data gathering techniques in this study.

3.2 Research Methodology

This study is located within an interpretive paradigm. Cohen, Manion and Morrison (2007:22) state that the interpretive paradigm aims at understanding the subjective world of human experiences. They further argue that an interpretive approach is characterized by a concern with the individual's actions or interpretations during a certain process.

Within this framework a qualitative case study research approach was adopted (Stake, 2000:242). Cohen et al. (2000:182) argue that a case study focuses on practice, intervention and interpretation with the aim of improving a situation. This was most suitable for my study as its focus was on the meaning-making of learners and educators with regards to the use of prior everyday knowledge and experience pertaining to acids and bases.

My interest was to observe how learners would respond to science as subject when teaching them using the everyday resources they are familiar with at their homes as proposed by Oloruntegbe and Ikpe (2011) in their study. Rennie (2011) too outlines the importance of relating science knowledge and skills to everyday life experiences. She further argues that scientifically literate people are interested in understanding the world around them.

As mentioned above, this case study investigated the benefits of using prior everyday knowledge of learners when teaching acids and bases to a Grade 7 class with the hope that it would present the researcher with authentic examples of real circumstances that would in the long run allow other Natural Sciences teachers to understand the ideas involved in this study more clearly (Cohen et al., 2007: 253).

For example, as presented and discussed in Chapters 4 and 5, this study presented me with real situations that concern both teachers and learners. According to the data found, although there were advantages of integrating everyday knowledge of learners in the teaching and learning of acids and bases it was obvious that there were challenges that also emerged and needed immediate consideration.

3.2.1 The Pilot Study

A pilot study can be regarded as a small-scale trial run of all the aspects planned for use in the main inquiry (Strydom, Fouche & Delport, 2004: 206). Strydom et al. (2004) argue that a

pilot study helps the researcher to fine-tune the study in preparation for the main inquiry. This pilot study was conducted in 2010 at the researcher's school with the Grade 6 Natural Sciences teacher as a participant observer and with Grade 7 learners in order to help clear any ambiguities in the data gathering tools.

Firstly, in this phase of my pilot study I had discussions with my colleague, a Grade 6 Natural Sciences teacher, about integrating prior everyday knowledge and experiences of learners in science. I did this because I was preparing her for the main research as she agreed to be one of the participant observers during my research process. She pointed out that, although it is not easy to integrate prior everyday knowledge of learners in science lessons it is helpful to do that as learners can draw from their experiences and interact during such lessons.

As an example, she mentioned that in one of her lessons a learner had an idea that eggs float in water when they are rotten but it was difficult to reason that out in terms of scientific explanations. That is, a rotten egg has gas inside increasing its buoyancy.This example alone clearly shows that learners have some understanding of matters around them but there might be great confusion and misunderstanding as to why certain things occur.

Secondly, questionnaires were used to elicit learners' prior everyday knowledge of what they use at home in relation to acids and bases. Irwin (2002: 4) suggests that in questionnaires respondents are required to answer a series of questions in writing rather than verbally. Cohen et al. (2000:248) state that less structured questionnaires are more suitable for a case study as they can help to capture the specificity of a particular situation.

As a result, the pilot study has helped me as a researcher to understand how to structure my data gathering techniques and to understand better the context at which the research was going to be conducted. That is, how to draw questionnaires for learners (what to consider when giving questionnaires to learners)? What is important when drawing up interviews both for learners and teachers? What aspects need to be considered when planning such research and when observing lessons?

Moreover, since it was going to be my first time using a video recorder it was important to learn how to use it so that I would be able to teach the person who helped me in recording lessons in the study. Mostly the pilot study has highlighted the importance of my research topic.

3.2.2 Sampling

The researcher

I have been teaching for almost nine years. Natural Sciences and Mathematics have been my interest since my school years. I must admit that most of the learners had found the subject boring and difficult to understand. I noticed that due to curriculum changes things are not the same as they were when I was a learner or student. Rote learning (traditional approach) was the only way to go when teaching and that could be one of the reasons why science was seen as a difficult subject or a subject only for certain individuals.

These days it is important to make sure that learners' understanding has shifted from their point of view to the actual scientific content (Woodley, 2009). To remedy the situation different strategies have been brought forth for teachers to use in their science classes. Thus, in this study I tried to bring forward another strategy that could be utilised by teachers in their science classrooms.

Selection of participants

This study was conducted in a small public school which is from Grade 0 to 9, (GET-Band). This school is known for its excellent academic results due to the commitment of teachers and management of their work. The school is also supported by the Catholic Church since it was started by the nuns for the Grahamstown disadvantaged community, but after 1994 the government took over.

Although it is known for its good education the school is very similar to other disadvantaged public schools. For example, there is a lack of resources such as a laboratory and other important facilities. Shortage of teachers and large classroom numbers is also a problem at this school. The school has diverse teaching staff and the language of learning and teaching (LoLT) is English but the learners' home language is *isiXhosa*.

The Grade 7 learners comprised my case study unit. This class has 38 learners (boys and girls) and they are more or less from the same community. In my school, I used to teach Natural Sciences from Grade 7 to 9, but from January 2011 I was asked to give away the Grade 7 Natural Sciences to a Technology teacher since I also teach *isiXhosa* home language

as well. Although this was the case, it was the technology teacher's first time teaching Natural Sciences, which is something that motivated her to willingly observe during my lessons.

Hence, the intermediate phase Natural Sciences teacher and the Technology teacher were the two participant observers and critical friends in this study. Both these teachers are more experienced teachers than I am and they both teach subjects that are related to this topic. This was to my advantage since their experiences would be of help to us all during this research process. Furthermore, as a result of being involved in this study, the Grade 6 Natural Sciences teacher is hoping to further her studies (Bed Honours degree) in 2012.

This sampling was purposive (Cohen et al., 2007) because I selected people that could benefit in this study. The teacher from another school (second interviewee) was a Grade 7-9 Natural Science teacher, and the two participant observers were also both Natural Sciences teachers. Although it was going to be the first time for a Technology teacher to teach Grade 7 Natural Sciences she also learnt and benefited in this study.

Table 2: Profile of the teachers involved in this study

DESCRIPTION OF TEACHERS INVOLVED IN THIS STUDY					
Teachers	Gender	Age	Qualifications	Experience in Teaching	Role played in this study
T1	Female	40	HDE (SP) – Specialised in sciences	15 years	Interviewee, a participant observer & a critical friend.
T2	Male	±45	BEd (SP) – Sciences	20 years	Interviewee
T3	Female	36	STD/ACE – In Technology	13 years	Participant observer & a critical friend
T4	Female	33	BEd (HONS) – in education science & education management.	9 years	The researcher

3.3 Data gathering techniques

Document analysis and **questionnaires**were used to gather baseline data in this study.Yin (2003:85) points out that documentary information is likely to be relevant to every case study, because it can take different compositionsand should be the object of unambiguous data gathering plans.

In this study, document analysis gave me a comprehensible understanding of the Natural Sciences issues in both the Intermediate and in the Senior Phase. I analysed three textbooks used in the Senior Phase. The analysis of two of these textbooks showed that they were written and aligned to the curriculum. Pertaining to the Intermediate Phase NS content demarcation document, I realised that there was no teaching of acids and bases in that phase (IP). In contrast, in the Senior Phase the document included acids and bases in Grade 9 where learners should be taught the reactions of acids and bases.

In this study, questionnaires were meant to document learner profile and to elicit their prior everyday knowledge in acids and bases. Thus, questionnaires were planned according to the information needed and made easier to understand because of the learners' level. Cohen et al. (2000) suggest that the aims and objectives of a questionnaire need to be determined as part of the planning of the research process to answer the research question. I must say learners together with their parent/s had answered the questionnaires very well and gave the information needed correctly.

The main data gathering techniques for this study were **semi-structured interviews, observations (videotaped lessons) and focus group interviews** with learners (Section 3.4). Both the base line interviews (with the two teachers) and the focus group interviews played an important role in this study. The semi-structured interviews informed the study while the focus group interviews provided opportunities for reflections on the study (Section 3.4).

In this study the above techniques were used successfully as each data is discussed and outlined in the next chapter. Interviews were transcribed and given back to the two teachers to verify their responses. Videotaped lessons together with the reflections from the two participant observers were analysed lesson by lesson and themes that emerged are discussed and outlined in the next chapter. Cohen et al. (2000) argue that the rationale for using

different data generation techniques (a process known as triangulation) is to ensure trustworthiness and validity of data generated.

Trustworthiness ensures that there is consistency in the findings even if the enquiry were replicated with similar respondents in a similar context by a different researcher (Lincoln & Guba, 1985: 290). Gray (2004) too explains that validity is ensured if the research instrument measures what it is intended to measure. Cohen et al. (2000: 109) also indicate that external validity refers to the degree to which the results can be generalised to a wider population, cases, or situations. Thus, by using different data gathering techniques in this study it was hoped that these techniques would complement oneanother.

As evidenced by the research findings, the techniques used in this study really complemented each other. The data from each technique was coded using numbers and the similarities and differences were identified from each data. This helped me as a researcher to analyse my data with more insight.

3.4 Research Process

Phase 1

For this phase, the Revised National Curriculum Statement (RNCS) for Natural Sciences Grades 7-9 (2009) and two textbook sections were analysed in order to understand how acids and bases are presented. I thus found out that in the intermediate phase (IP) there are no acids and bases taught while in the senior phase (SP) they only start from Grade 9 (Section 3.1).

Furthermore, from this document it is stated that the use of both everyday substances and laboratory substances is important when teaching acids and bases. This helped me to verify the importance of my study. Moreover, I noticed that it is a lot of work and knowledge for learners to start acids and bases only in Grade 9 since there are many concepts to introduce under this topic. For example, in Grade 9 learners have to learn and be introduced to acids and bases while at the same time they have to learn more about acids and their chemical reactions as well.

As a result, I noticed learners grappling with these concepts especially in Grade 9 where there is a lot to learn within a short period of time. Thus, I thought that it would be great for learners to start understanding acids and bases from Grade 7 where they would be introduced

to these two concepts using everyday resources as mentioned above before they proceeded to Grades 8 and 9 where they would be introduced to laboratory substances and chemical equations on acids and bases. In effect, this should be the case as the Grade 7 textbooks include acids and bases as topics. The confusion arose when the Department of Education (DoE) tried to change the syllabus several times and subsequently there were gaps in the content.

Table 3: Document analysis presentation – NATURAL SCIENCES textbooks

Grade	Author/s	Year	Title	Place of publication	Publisher
7	J. Avis, R. Khalipha& K. Morrison	1998	Science Now Textbook 1	Sandton	Heinemann
7	Clarke & I.M.B. Thoka	1994	Successful Science Textbook 2	Cape Town	Oxford
7	K.Barker, S. Cohen, S. Doubell, N.Mgoqi, V. Mkhwanazi &P.Mzolo	2006	Science Today Learner's book Textbook 3	Cape Town	Maskew Miller Longman
7-9 RNCS	DoE, Eastern Cape	2009	NS-Revised/Content mapping and work schedules	Eastern Cape	Education Department

Phase 2

Initial **semi-structured interviews** (Appendix D) were held with the Grade 7 to 9 teacher from the other school in order to find out his perceptions and howhe approached the topic of acids and bases during teaching and learning. This helped me as a researcher gain more insight on this topic. I chose semi-structured interviews because of their flexibility and they allowed me to probe participants to gain an understanding of their world views.

Sanders (1999:383) argues that semi-structured interviews ensure that specific questions will not be omitted. Lending support to this, Wilkinson (2004:44) asserts that open questions allow a respondent to insert his or her own views, ideas or suggestions about the question posed. The second interview with the Intermediate Phase (IP) teacher from my school (the

Grade 4 to 6 teacher who was the participant observer in this study) was conducted before and after the observations. The second interview was done in conjunction with the reflections while watching the videotaped lessons. The initial interviews were audiotaped as this helped me to analyse the data andfield notes were made during both interviews to guide me when transcribing.

Phase 3

Initially, for this phase I gave out **questionnaires** (Appendix E) to the Grade 7 class involved in the study so as to ascertain what kind of substances they normally use at home relating to acids and bases (elicitation of learners' prior everyday knowledge). These questionnaires were divided in to two sections.

Section 1 was about elicitation of learners' prior everyday knowledge on acids and bases. Section 2 documented the profile of the learners in order to gain insight into their socio-economic background as it is assumed that this can inform what they bring to class.

These questionnaires were completed on different days as I wanted honesty from learners. Furthermore, because of their age I had to give them enough time to complete the questionnaires properly with the help of their parents at home.

Phase 4

In this phase, five lessons (Appendix G) were observed by the two participant observers while I was teaching and the lessons were videotaped. The purpose of these observations was to investigate how I as the Natural Sciences teacher elicited and integrated prior everyday knowledge and experiences of learners during practical activities using easily accessible resources commonly used at home. With the help of videotaped lessons, I was hoping to see how learners shared their views with others, how learners interacted in group discussions by answering questions, and furthermore how learners interpreted and understood concepts associated with acids and bases.

Cohen et al. (2000) claim that observational data helps the researcher to generate information from real situations or contexts, thus enabling the researcher to engage and comprehend the described situation. Hopkins (1996:91) suggests that during observations there is a need for observational schedule since it develops the sense of ownership over the subject to be observed. However, before drawing up an observation schedule there should be clarity on the

rationale of the observation which can be attained through following questions as proposed by Hopkins (1996: 91).

What is the purpose of the observation? What is the focus of the observation? What participant behaviours are important to observe? In this case I adapted the Integrated Quality Management System (IQMS) observation sheet (Appendix F) from the DoE for teachers. This observation sheet is used to score teachers during teaching and learning in their classrooms by their Developmental Support Groups (DSGs) in their schools. It also looks at the level of teachers in terms of their work involvement in their schools.

I believe that the appropriate use of such a document by teachers can help them to grow academically. I chose this observation sheet because I thought it would be best suited for my study since it looks at amongst other things, the following: the organisation of the classroom, the interaction of learners amongst each other, the engagement of learners in a lesson.

Table 4: Summary of data gathering techniques

BASELINE DATA	
Methods	Reason for using this method
Document Analysis	To check the outline of acids and bases.
Questionnaires	Learner profile & Elicitation of learners' prior everyday knowledge on acids and bases
Semi-structured interviews (1 and 2)	To capture teachers' understanding of acids and bases, how teachers approach the teaching of science in their classrooms and to validate the research topic.
MAIN DATA	
Lesson observations	To understand the meaning making during teaching and learning of acids and bases. How learners interact with each other during these lessons & how the teacher interact with learners.
Focus group interviews with learners	To see if learners understood the lessons or the concepts of this topic and ascertain whether or not learning took place.
Stimulated recall discussions with the participant observers while watching the video	To try and clear some misunderstandings during this process and to give more clarity to the lesson presentations during observations.

3.5 Data analysis and validation

In this study, inductive analysis was applied as described by Danermark, Ekstrom, Jakobsen and Karlson (2002) showing that seeing similarities and differences in a number of observations is crucial. Patton (2002:41) describes inductive analysis as the investigation of data to discover patterns and themes resulting in a creative synthesis. During the process of analysing the data, I thus looked for trends, similarities and contradictions.

For example, the data from learners' questionnaires on elicitation of their prior everyday knowledge gave me some insight into their prior everyday knowledge and experiences. On the other hand, the data from the learner profile gave me some insight into learners' backgrounds, that is, where learners come from and with whom they stay at their homes. The base line data, the questionnaires and document analysis helped me in planning my lessons as well as in considering the level of learners.

I returned the interview transcripts to the teachers and compared my discussion summaries with theirs in order to verify their responses. In this study the intention was to investigate aspects of knowledge and concepts held by learners and teachers before and after the teaching and learning of acids and bases. To validate my data, I also watched the videos together with one of the teachers whom I interviewed in this study. I had hoped to watch the video lessons with both teachers but due to our different schedules we could not meet with him since he was from another school as well.

Table 5: The Approach Followed on Data Analysis – Making sense of the data

Method	The purpose	How was data analysed?
Questionnaires (section 1)	Learner profile	The interest was on the learner and his/her parents. Parents: The type of work, education, single or married. Learners: Aspirations, academic interest, and the kind of chores done at home and performance at school. (38 learners were profiled).
Questionnaires (section 2)	Prior everyday knowledge of learners in acids and bases	This was in 2 subsections: Section A: learners were given a list of substances that might be found at home (acidic and basic substances). They needed to verify which ones they were familiar with and which ones they are not. Section B had open – ended questions based on acids and bases.
Interview 1	After analysing the RNCS document for NS in the GET band, I had to verify the syllabus for Grades 4-9 on acids and bases and to find out if the teacher recognised the importance of prior everyday knowledge of learners when teaching NS.	In this interview I looked for the interest of the teacher in NS and how far she challenges the given syllabus (RNCS). The strengths of the teacher and the weaknesses in terms of broadening the science content for her learners. The importance of prior everyday knowledge in her teaching.
Interview 2	The focus in this interview was more on how the teacher approached acids and bases since he was a SP teacher just like the researcher.	Does he follow the RNCS document or not? What strategies does he use for his learners to understand the concept of acids and bases? Accommodation of learners in his lessons?
Observation of lessons	What takes place during the teaching of acids and bases? With the help of the videotape and the participant observers I was able to observe whether learning took place or not, looking at the discussions in class, the questioning, the practical activities etc.	Comparing the activities- what level, are they able to probe understanding, Discussions- from learners- Scientific language use, Presentations- during this process, understanding of questions Practical activities- learning, fun and the test- what comes up?
Focus group interviews	To see if learners understood the lessons or the concepts in this topic and whether or not learning took place.	How did learners understand the topic? Note how they give answers, what was challenging for them and what was interesting? Did they learn anything or not?
Stimulated recall discussions with the participant observers	To try and clear some misunderstandings during this process and to give more clarity to the lesson presentations during observations.	The aspects that came out during these discussions concerning the lesson observations. What improvements and challenges are brought up?

3.6 Ethical considerations

Cohen et al. (2000:246) describe the research respondents as subjects and not objects of research that need to be respected. Having given informed consent to the research, the respondents still had the right to withdraw at any time and were guaranteed that the research would not harm them in any way. Murray (2006) also highlights the point that consideration of ethics is of fundamental importance to all research.

As mentioned above, I asked permission from the District Department of Education (DoE), from the school involved in this study (the principal and the two participant teachers) as well as parents' permission since most learners were still minors. I ensured that the identity of participants was not disclosed as well as the data generated by my research being kept confidential. Request letters were sent to all the stakeholders involved in this study (Appendix A). I assured the grade 7 learners that I would not harm or misuse their reputation as much as there will be no names used in this study.

After the research I hope to give the school and the District Department of Education each a copy of my thesis so as to build trust for future research purposes.

3.7 Conclusion

In this chapter, I have described the paradigm underpinning this study, the methodology as well as data gathering techniques that were used to respond to the questions in this study. The research process that was followed inthis study is also discussed with reference to each technique used in this study, the document analysis, questionnaires, interviews and lesson observations.

How the data was analysed and validated in this studyis also discussed in this chapter. Moreover, ethical issues are also described according to how each stakeholder participated in this study. Lastly, tables are provided in order to give a clear understanding of the participants in this study.The data generating techniques are also outlined in tables to show sequence and the approach regarding how they were used and analysed in this study. The next chapter presents findings from the base line data and the main data.

CHAPTER FOUR

DATA PRESENTATION

4.1 Introduction

In this chapter, I present the findings obtained from thedata-gathering methods used for this study, namely, document analysis, questionnaires, lesson observations, focus group interviews, and stimulated recall discussions.

In Chapter 3 I highlighted that data from document analysis and the questionnaires formed the base-line data for this study. Data from lesson observations, focus group interviews and stimulated recall discussions formed the main data for this study.

This chapter begins by describing how the examples of each situation or each data were chosen. Thereafter, findings from each technique are presented sequentially as arranged in Table 5.

4.2 The selection of examples from each data set

An example of data that is extracted in this chapter was chosen according to the following categories:

- Direct quotes are used to showcase learners' position.
- I randomly chose to compare learners with a good support system from home (parents that I think have better jobs than others).
- I also considered the education of the parents.
- I selected the interesting cases, for example, the three 12 year old learners.
- I used two focus groups (the two groups that were interviewed after this study).
- Lastly, although my research is not based on the challenges encountered by learners I also extracted a few challenges such as language, writing skills and social support.

4.3 Document Analysis

4.3.1 Textbook1: *Science Now*

This textbook does include the topic of acids and bases. In my opinion, it is at the Grade 7 level in terms of pictures used. The language used and the content is suitable for this grade as it gives daily examples of acidic and basic substances. Examples given in this textbook include: vinegar, fruit salt, milk, ammonia and bicarbonate of soda. It could be concluded that it does promote the use of everyday substances in teaching science lessons on acids and bases.

Another important aspect about this textbook is that it is designed to promote Outcomes Based Education (OBE). It thus promotes the interaction and the involvement of learners during the science lessons. Furthermore, the use of accessible resources in science is intended to make learners view this subject as something with which they are familiar.

The content for learning about acids and bases in this textbook is outlined as follows:

- Properties of acids and bases;
- Classifying substances as acids, bases or neutral;
- Explain the function of the indicator;
- Make your own dyes to use as indicators;
- Make your own soap; and
- Useful acids and useful indicators.

4.3.2 Textbook 2: *Successful Science*

This textbook is one of the textbooks that were designed before the new curriculum, that is, before the implementation of OBE. Despite this, it also uses daily examples of acids and bases. In addition to this, it also gives examples of laboratory acids. The content for learning about acids and bases in this textbook is outlined as follows:

- Acids and bases (everyday examples).
- Indicators in everyday life.
- Practical activities of indicators and acids.
- Practical activities of indicators and bases.
- Neutralisation using indicators.

- Neutralisation in everyday life.

4.3.3 Textbook 3: *Science Today*

This Grade 7 textbook is a bit different from the two already mentioned and it has been designed to suit the needs and the topics for the National Curriculum Statement (NCS). This textbook is used by most schools and it *does not* cover the topic of acids and bases ignoring that it is essential for the Grade 7 curriculum. This shows that while the Department of Education (DoE) is trying to design a curriculum that will suit the needs of all learners in South Africa there are missing gaps in the newly designed curricula.

4.3.4 The RNCS document: Content Mapping and Work Schedules (Grades 4-9)

According to this document, acids and bases only start in Grade 9 where learners need to be introduced to this topic and at the same time be taught about the reactions of acids and bases. Acids and bases are under the theme Matter and Materials. Quite interestingly, acids and bases are not part of the curriculum across the intermediate phase.

In the senior phase (Grade 7 – 9), the subject of acids and bases only starts being taught in Grade 9 and is clustered into many different topics. I believe that, to cluster these different topics under acids and bases at the same time may confuse learners and even teachers. The confusion maybe caused by not having enough time to go through the whole syllabus at the same time without the background knowledge. As a result, learners may not understand the processes and concepts involved in this topic.

The document analysis has given me insight into the level at which acids and bases should be taught in both the intermediate and the senior phases. In my view, this topic could be spread throughout these phases in order to help learners thoroughly understand the concepts involved.

4.4 The Questionnaires

Since there is a belief that learners' prior everyday knowledge and experiences are informed by their surroundings or the environment in which the learners come from, I tried to understand each learners' situation through questionnaires (Learner Profile: Appendix E). The questionnaires were in two sections: section 1 constituted the profile of learners while section

2 constituted the elicitation of learners' prior everyday knowledge and experience related to acids and bases. The profile of learners highlighted the socio-economic background of each specific learner.

The section on the learner profile had subsections: section A is based on the learner him/herself; section B is based on the profile of a parent or a guardian; section C is based on the aspirations of a learner; section D is based on the academic interest and the level of her/his performance at present. Lastly, sections E and F are based on the extra-curricular activities at home and at school.

All questionnaires were numbered from 1 to 38 so as to identify the information about each learner. To identify the questionnaires I asked learners to write numbers instead of names.

4.4.1 Questionnaire1: Learner Profile

Table 6: showing the results from section A. Symbols used in this table: M – male; F – female; BP – both parents; M – mother; U/A – uncle & aunt; GP – grandparents; PT – public transport; T – private transport; W – walking; SB – school bus.

No	Age	Gender	Grade Repeated?	Stay With at Home?	Transport to school?	Kilometres if walking?	Where do you stay?
1	13-14	M	-	B P	PT		Ext 7
2	13-14	M	7	mother	SB		Joza
3	13-14	F	-	BP	T		Ext 6
4	13-14	F	-	BP	PT		Joza
5	13-14	M	-	BP	SB		Ext 6
6	13-14	F	-	BP	PT		Ext 7
7	13-14	M	-	BP	PT		Ext 7
8	13-14	M	-	BP	W	2-3 km	Fingo
9	13-14	M	1	BP	PT		Ext 6
10	13-14	M	-	Uncle & Aunt	W	2-3 km	Fingo
11	13-14	F	-	BP	PT		Ext 7
12	13-14	M	-	BP	PT		Town
13	11-12	M	-	mother	W	1 km	Fingo
14	13-14	M	-	BP	PT		Ext 8
15	13-14	M	-	mother	W	2 km	Hlalani
16	13-14	F	1	GP	PT		Joza
17	13-14	M	-	BP	PT		Ext 7
18	13-14	M	1	BP	W	2-3 km	Fingo
19	13-14	M	1	mother	W	1 km	Fingo
20	13-14	M	-	mother	W	1km	Fingo
21	13-14	F	-	mother	PT		Ext 6

22	13-14	M	-	BP	W	2 km	Fingo
23	13-14	M	-	mother	W	2 km	Fingo
24	13-14	F	-	BP	PT		Ext 9
25	11-12	M	-	BP	W	3 km	Fingo
26	13-14	M	-	BP	T		Ext 6
27	13-14	F	-	BP	W	3 km	Fingo
28	13-14	F	3	mother	T		Joza
29	13-14	M	-	mother	W	2 km	Fingo
30	13-14	M	-	BP	W	2 km	Fingo
31	11-12	F	-	BP	PT		Joza
32	13-14	F	-	mother	PT		Ext 8
33	13-14	M	-	GP	PT		Joza
34	13-14	F	4	BP	W	3 km	Fingo
35	13-14	F	-	mother	PT		Ext 6
36	13-14	F	-	GP	T		Joza
37	13-14	M	2	BP	PT		Joza
38	13-14	F	-	BP	SB		Joza

Table 6 (section A of questionnaire 1), provides an analysis of learners in terms of their age group, whom they stay with at home and how far they stay from school. Moreover, this table gives information on how these learners go to school each day. From this table, one can assume that these learners are coming from firm backgrounds since most of them are staying with both parents and very few of these learners are living with their relatives.

Eight of these learners had previously repeated a grade. This suggests that some of the learners from this class might have learning difficulties, but that could not be the only factor for learners to repeat a grade. In my assumption the approach I used helped all learners to be interested in this lesson (see analysis of test results as reflected in Graph 3).

Furthermore, in the above table there are three learners who are younger than all other learners. They are 12 years old. Learner 25 (**L25)** is a boy that lives with both parents and he is the only child. His mother is a teacher and his father works as a general assistant in a hospital. This child's academic performance ranges between 'satisfactory' and 'poor' in maths and science. One could ask himself or herself, what could be the reasons for this? According to my assumption, it could be the fact that he does not get enough support from home or he might be one of the underperforming learners in this class.

L31 is a girl and she is also 12 years old. But, this learner unlike **L25** seems to be motivated and wants to know more about her school work. She rated herself between 'good' and

'satisfactory' in the Natural Sciences. She also mentioned that she would like to know more about maths and science. It was the same as **L25** who also stays with both parents who, although working, are not as educated as **L25'**s parents. The two 12 year old boys in this class seem to be a little bit shy or quieter than the 12 year old girl. This character has been shown throughout the process of this study.

Some results from Table 6 were then summarised as percentages in the following graph:

23/38(60.5%) Male; 15/38 (39.5%) Female; 8/38 (21.1%) G Rep; 23/38 (60.5%) Both P; 11/38 (28.9%) Mother; 1/38 (2.6%) U/A; 3/38 (7.9%) Grand P; 17/38 (44.7%) Pub T; 3/38 (7.9%) School B; 4/38 (10.5%) Taxi; 14/38 (36.8%) Walk.

Graph 1: Summarises some results from Table 6 (section A of the questionnaire).

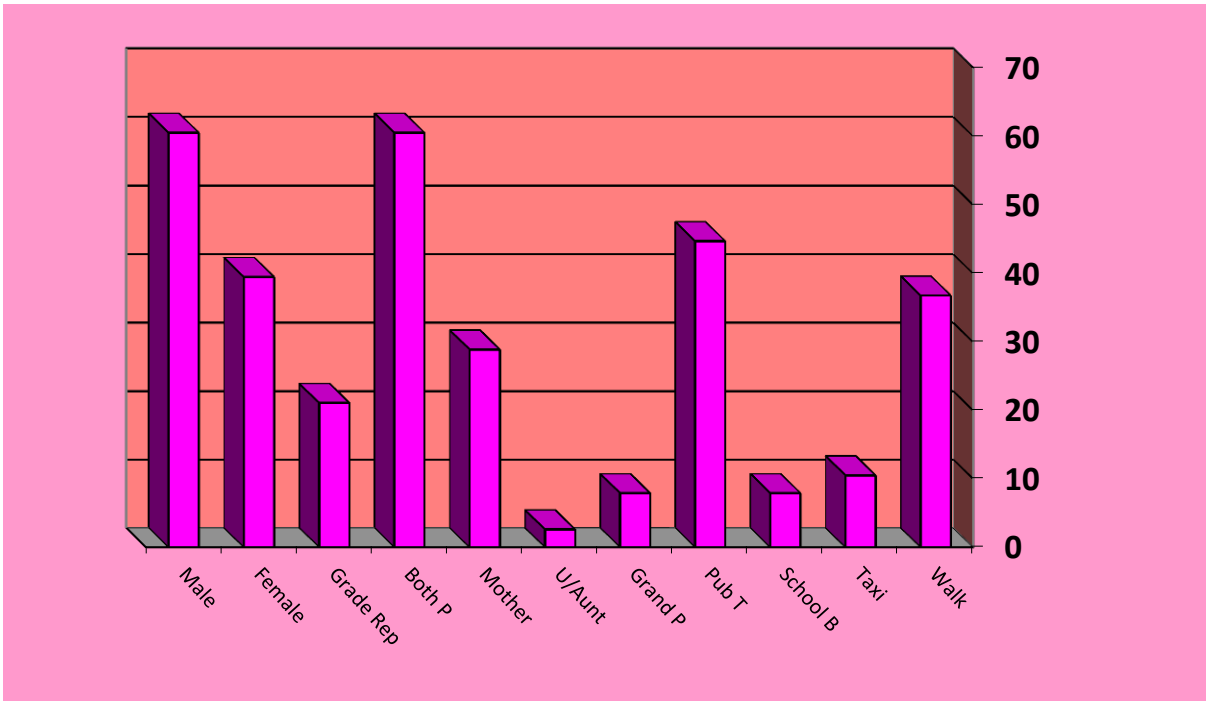


Table 7: results from section B (parent's careers & education)

No	Employed	Unemployed	Place	Highest Education
1	Yes		Garage in PE- mechanic	Degree in engineering
2		Self employed		STD 9
3	Yes		DoE-Office work	Diploma
4	Yes		Domestic worker	STD 8
5	Yes		Domestic worker	STD 10
6		Self employed	Taxi owner	Diploma
7	Yes		Domestic worker	STD 10
8	Yes		Petrol attendant	STD 9
9	Yes		Cleaner/ Hospital	STD 10
10	Yes		Teacher	Diploma
11	Yes		Teacher	Degree
12	Yes		Cleaner/ School	STD 9
13	Yes		Health worker	Degree
14	Yes		Domestic worker	STD 10
15	Yes		Teacher	Diploma
16		Pensioner		
17	Yes		House Keeper	STD 10
18		Self employed		
19	Yes		Domestic worker	STD 8
20		Self employed		STD 10
21	Yes		Cashier	STD 10
22	Yes		Domestic worker	STD 9
23	Yes		Soldier	STD 10
24	Yes		Caregiver/ Cleaner	STD 10
25	Yes		GA/Hospital/Teacher	STD 10/ Degree
26	Yes		Both teachers	Degree
27	Yes		Furniture Shop	STD 8
28	Yes		Pre-school	Diploma
29	Yes		Teacher	Diploma
30	Yes		Nurse/hospital	Diploma
31	Yes		Security /HITEC	STD 10
32	Yes		Cook/SPUR	STD 8
33		Pensioner		
34	Yes		Police officer	STD 10
35	Yes		Domestic worker	STD 10
36		Pensioner		
37	Yes		Truck driver	STD 9
38	Yes		Plumber/ KFC	STD 10

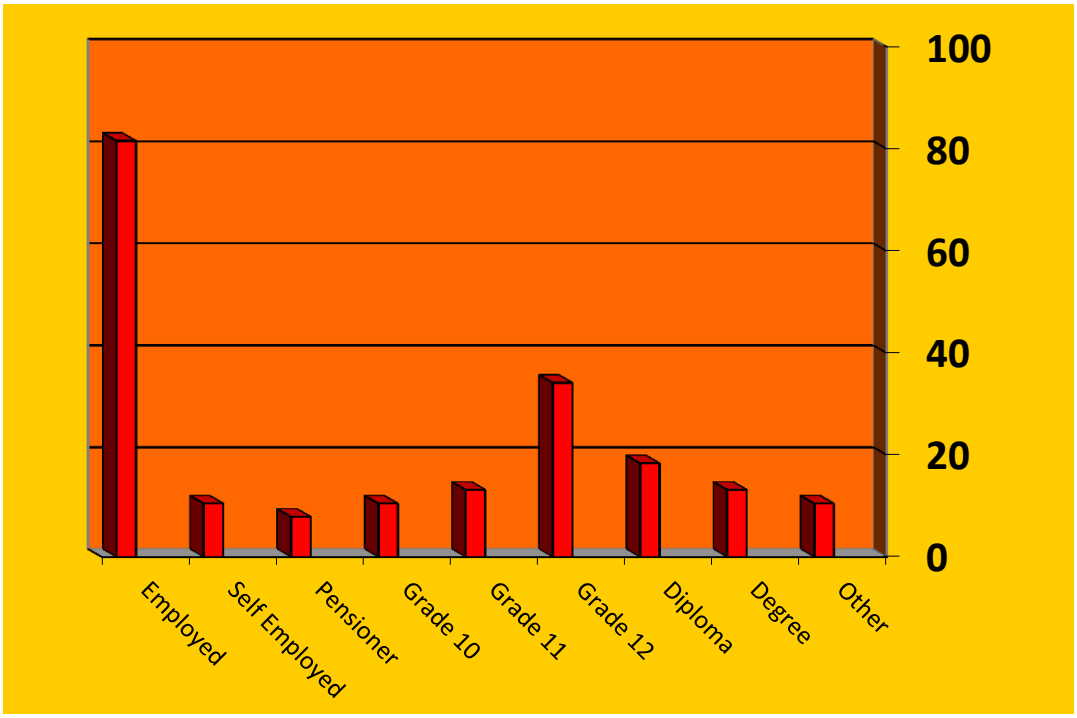
From Table 7, it is clear that about 80% of the learners' parents in this class are working and can at least support their children financially. But what is significant about these learners' parents is that, although they are working not many are in well-paying jobs. Most of them are domestic workers or cleaners. Nonetheless, the fact that some of these parents are domestic workers has relevance for my study.

Again, it seems that most parents can try and support their children academically. But the answer to the question would involve looking at the type of jobs they do - are they able to support their children in their school work?

When I asked learners to bring the resources from home they had no problem and we shared the resources in class. Each learner brought what he or she had.

The results from Table 7 were also summarised as percentages in the following graph:

Employed 31/38 = 81.6%; Self-employed 4/38 = 10.5%; Pens. 3/38 = 7.9%;
Grade 10 (4/38) = 10.5%; Grade 11 (5/38) = 13.2%; Grade12 (13/38) = 34.2%;
Diploma 7/38 = 18.4%; Degree 5/38 = 13.2%; Other 4/38 = 10.5%



Graph 2: Results from section B (parent's careers & education)

The next section explains learners' interests and aspirations.

Section C: Learners' aspirations

This section looked at the learners' interests and their role models for their future careers. It also looked at the needs of learners from the school, that is, the support they need with their school work.

Most learners in this class look up and see their parents as people who are most important to them. According to these learners, this is because they care for them as their children. For example: **L12** highlighted that the reason why his parents are his role models: *"it is because they listen to me, they advise me when necessary and most of all they take care of me"*.

These learners seemed to be motivated because most of them agreed that they needed extra support in some of the learning areas. In my assumption it is rare for learners to admit that they need help, especially with their school work. Drawing from the questionnaires, I must admit that there are very few learners in this class who are interested in science- related professions in the future. Maybe relating science to learners' everyday lives could help with this problem. I think that including learners' everyday experiences in their lessons could motivate them to enjoy and love science.

SECTION D: Learners' academic performance and interests

Most learners seem to rate themselves as average in their performance in the Natural Sciences. For instance, most learners rated themselves between 'good' and 'satisfactory'. However, although they rated themselves in these categories they seem to want to know more about science and mathematics. They even mentioned that they would like extra help in these subjects. They also highlighted that they would love to have more practical activities in Natural Sciences because they enjoy them and they do learn from them.

As I had two focus groups for interviews, I decided to select some learners' questionnaires from these groups. These helped me to understand the learners better and gain more insight into their academic interests. I found out that **L29, L32** and **L35** were the better performing girls in this class and I drew this knowledge from their previous Grade 6 teacher. Looking at their questionnaires as well, I noted that they were interested in science-related careers; for example, **L29** would like to be a geologist. Meanwhile,**L32** would like to be a climatologist.

In my view, these learners could have been motivated by the fact that the library use as reading of books in this school is one of the most important activities. As a result, learners are often encouraged to go to the library andfind information when doing assignments and projects. Learners are even encouraged to read books more often so as to extend their vocabulary. Sometimes teachers even take their learners to the library for visual lessons

especially when using videotapes for certain topics. Lastly, the school also allocates some library periods for learners to read novels or interesting stories.

SECTION E: Chores from home

According to the information obtained from the questionnaires, learners in this class do help their parents with some chores at home. This is because most parents are working so they do ask their children to help in every way when it comes to household chores. Most learners (both boys and girls) indicated that they do wash dishes every now and then and they even clean the house sometimes. Very few learners mentioned that their parents said that they were still young to do such chores and they needed to concentrate on their school work.

My assumption is that learners that perform some chores at home are the ones who have better chance to relate more to this topic (acids and bases) since they are familiar with these everyday resources. Hence I think it is important for parents to encourage their children, both girls and boys, to at least help with some chores at home. This could increase their curiosity about things around them.

SECTION F: Extra-curricular activities

Learners in this school are encouraged to participate in different extra-curricular activities. However, the school only offers netball, rugby, soccer, choir, and volleyball. In addition to this, the school has different clubs as well, namely, the environmental and ignition club. The environmental club helps in the cleaning of the school and its surroundings. The ignition club is a support group where most learners interact with others to share their life stories and also help the community. For example, the ignition club visits hospitals and makes donations to the poor. These are the two most popular clubs in this school. This is because these two clubs are mostly working with the community and learners like to be out there meeting new people.

Most learners in this class indicated that they do participate in either of the above mentioned activities. Although there are different activities to choose from, there were learners who indicated that they do not partake in extra-curricular activities. The likelihood is that these learners are not interested in their school work as well and perhaps have some learning or social problems. Although extra-curricular activities are not really part of my study, my assumption and my observations throughout my teaching years led me to believe that the

learners who are interested and active in our school are always the ones who perform well academically in class. This is something that I observed so far as a teacher.

Regarding involvement in the Khanya Maths and Science Club, learners have shown an indication that they would love to be part of this club but there are limited numbers that are accepted. This means that the club accommodates only a few learners from each school. By contrast, **L1** mentioned that maths is too difficult for him so he would not want to be part of the club. This learner seems to have lost motivation for science and maths. He rated himself as 'poor' in maths and 'satisfactory' in science.

What came out from these questionnaires was that learners from this class are from homes that are supporting their children. The reason for the above statement is that most learners mentioned their parents as their role models. About 20% of parents from this class are not working and are pensioners or self-employed (owning small businesses).

The next questionnaire presents findings based on learners' prior everyday knowledge of acids and bases.

4.4. 2 Questionnaire 2 (prior knowledge of learners on acids and bases)

This questionnaire was three-fold. Part 1 listed substances that are acidic, basic or neutral. These were substances that were used in many homes. The purpose was to find out if learners were already familiar with such substances or not.

Secondly, learners were provided a space to write all the substances that they thought would be in the same group as the ones given to them. Lastly, learners were asked open-ended questions as to why and how some substances were used? They were required to draw from their everyday knowledge or from their understanding**.**

Part 1: List of different chemicals/substances that are found at home

In this part of the questionnaire, learners were familiar with most of the substances listed. But there were three significant substances that learners noted as unfamiliar. These were: ammonia, bicarbonate of soda and cream of tartar. When I asked learners to verify as to why they did not know these substances, they indicated that they never saw or heard about them. Therefore, I made sure I brought these three substances from home so that my learners could see them.

Part 2: Learners had to give similar substances

In this section of the questionnaire, learners had to independently list similar substances to the ones provided in part one. Learners were also asked to explain in what ways these substances were used. The main purpose behind this was for learners to compare substances that were listed in part one and find similar ones that were not listed. Learners were supposed to look at the uses of these substances and their properties as well. Most learners came up with the following: yeast, pineapples, *Sta-soft*, foam bath, hair shampoo and *Eno*.

Few of the explanations that came up were as follows: *Sta-soft* is used to reduce bad smells from clothes and make them soft as well. *Eno* is used to help heartburn. Pineapple tastes sour and sweet. Hair shampoo is used for washing hair and to remove hair products. Roll-on was among other items that were mentioned and most learners said that it reduced body odour.

From this questionnaire in part two, there were two learners **(L2 & L3)** who did not come up with their own substances either than the ones given to them. What I found of interest was to consider whether this was because they found it difficult to think of more substances or simply because they were not interested. In the case of **L2,** however, my thinking was that he might have learning difficulties and perhaps the questionnaire was too long for him as he had repeated Grade 7.In **L3**'s case it was difficult to detect the problem as he had not repeated any grade before.

Part 3: Open-ended questions

This part of the questionnaire mandated learners to offer explanations as to why certain substances were used by people. This section is important because in science it is necessary to give explanations and reasons for your actions especially in experiments and investigations. Again, there is a great demand for teachers to develop learners' reasoning and thinking skills in science classrooms.

In this section I had two questions where I was testing the learners' ability to compare and see similarities between natural resources and synthetic resources. For example, learners had to come with the uses of wood ash and they had to explain why were they used by people?

Examples of answers from learners were as follows:

L4: "Wood ashes are important and useful because it reminds people about that they are made out of ashes".

L13: "*Isetyenziswa ukugxotha iimbovane*" (It is used for repelling ants).

L21: "Ashes are useless to me but I see some people using wood ashes for their shoes".

L24: "Ashes are used to fertilise the potatoes and chasing away *iimpethu*" (Worms).

L27: "They are important because old people clean their teeth with ashes especially those who are living in farms and villages".

L30: "Ashes are important because people use them to reduce bad smell from the toilet".

I noted that about 85% of learners in this class are not familiar with the uses of wood ashes and learners were not aware that wood ashes form part of the substances that were listed in their questionnaires. The only significance of wood ashes to these learners was based on their church experiences. For example,*"Roman Catholics use ashes to put a symbol of a cross in the forehead during Ash Wednesday".* And this was the response from most learners.

In the second question, learners had to compare the traditional beer (*umqombothi*) and *umdoko* (the traditional drink made from mealie-meal). In these two drinks the brewing is more or less the same but *umqombothi* takes longer to ferment than *umdoko (amarhewu).* Moreover, learners needed to compare the ingredients and the measurements that are used when making these two drinks. Interesting answers from learners were as follows:

L1: "These two drinks use yeast when brewing"
"They are left to cool for some time"
"They have both the same taste and smell"

L5: "Umqombothi is the traditional alcohol"
"Umdoko is a natural drink"

L36: "Yes, I think there are similarities, they both use mealie- meal when brewing."
"Measurements depend to the size of your container."
"They both have a smell and a similar taste".

From the above two questions it was clear that learners do understand that substances differ in terms of taste, smell and colour. The above characteristics are very important when analysing and classifying acids and bases. This was the first step for learners to start looking at substances with a scientific eye. That is, when using substances from home they have to compare, classify and find explanations as to why certain substances behave the way they do. During discussions in class some learners even mentioned that in their homes they were asked to drink the traditional beer (*umqombothi*) during traditional ceremonies. As a teacher I was, together with learners, supposed to test all the substances they mentioned, but time was a challenge.

4.5 Interviews with the two teachers

4.5.1 Interview 1

In this interview there were four focus questions but some follow up questions were also asked. Before asking the focus questions I asked the teacher about her qualifications and her interests in this career, in order to make her feel comfortable during the interview.Based on this interview, I have described her qualifications and her teaching experience in Table 2. This interview took about 40 minutes. It took place from 12h00 on Wednesday, 09 February 2011 at my school.

Questions and responses:

From this interview some misunderstandings about my research were cleared up. To ease the teacher's mind, I started this interview by asking about her qualifications and interests in teaching. I also asked her about the challenges she encountered as a science teacher in these grades (4 to 6).

This teacher did her Senior Phase Teachers Diploma at Algoa College of Education. She then continued and did her Higher Diploma in Education (HDE) at the University of Port Elizabeth which is now called Nelson Mandela Metropolitan University (NMMU). Her majors were Maths, Physical Sciences and Biology. In her HDE course, she also did Remedial Education as a major subject. From my point of view, I would think Remedial Education should be studied by all teachers. It would be easy for teachers to observe and understand their learners so much better in order to help them with learning difficulties.

One of the important aspects that came out in this interview was that this teacher also saw the importance of connecting science with learners'everyday knowledge. During the interview, Miss G (pseudonym) mentioned these factors:

Q: As a Natural Sciences teacher what are the everyday and most challenging factors experienced when teaching in this phase (Grade 4 to 6)?

Miss G: "I think when asking questions from learners you expect learners to come up with good answers. Or their answers will show an understanding of what is taught in class. For me this is important as learners' answers guide us as teachers where to start your lesson. And their level of understanding is also important as they deal with science from home. But I found out that learners do not know how important their knowledge from home is. *Bayayibona into isenzeka ekhaya* but they see it as something different *kulento bayenza apha eklasini*." (Learners can see what happens at home but they cannot relate it to something done in class).

Miss G: "To add on what I just said to you, learners also think that science is something *engafikelelekiyo* forgetting that science is everywhere, *ekhaya*, and in their surroundings." (Learners think that science is something difficult, but it is everywhere from their home and in their surroundings).

From this response alone I picked up various factors about the importance of everyday knowledge. Firstly, according to this teacher one of the challenges she faces in her class is the fact that her learners cannot give clear answers and she expects answers that could help her recognise her learners' level of understanding in a specific topic.

Secondly, Miss G thought that if her learners could be able to distinguish the importance of their everyday knowledge that could make her teaching less challenging. Lastly, the other important point that I picked up from the above response was that Miss G also saw the importance of shaping her lessons according to her learners' level.

Q: How do you make sure your learners understand what you teach?
Miss G: "Sometimes when you teach you think that learners do understand you, but when you start asking them some questions it becomes a different story. You find that they have not even a clue what you have been teaching. So, sometimes it is better when teaching to ask

your learners to repeat after you when saying something and even ask them to say it in their own words. In that way you will see if they understand."

Miss G: "Again, this will make a teacher think of other strategies so as to make sure your learners understand you."

This response gave me the idea that Miss G is aware that learners can look as if they are listening and understanding the teacher but when asked some questions they would give the teacher something else showing no signs of understanding of what has been taught. She thus proposed that asking questions regularly while teaching could help learners to stay attentive in class. Also she mentioned that using different strategies in class was very important for learners as they would understand the topics better. I must say, however, that she did not mention anything about learners' questions which is a challenge for many teachers.

Q: How do you introduce lessons to your learners, especially new lessons?

Miss G: "As they are from the previous grade, I always ask them questions related to the new topic to see if they still remember what they did in that grade. If I see that they are struggling or forgotten I have to start at a lower level as I cannot start with the new topic. This helps me to build a good foundation for my learners."

Q: So, from your response do you think the assumption based on learners already knowing something is working? Because most teachers seem to think that since learners are from the previous grade they are supposed to just continue with a new topic.

Miss G: "No, no, no not at all… mh...a*yisebenzi njalo kwaphela* (it does not work like that at all). It will not help to move to a new topic while your learners are totally clueless. So you are building on their confusion and *ukungaqondi kwabo* (their lack of understanding)*."*

From the above question, Miss G made it clear that when teaching learners it was of value to check their understanding before you proceeded with the new topic. The assumption that learners are supposed to already know it did not work with Miss G because she saw that as a problem and confusion for learners. The next question was more interesting since I wanted to find out whether or not she teaches the topic of acids and bases in this phase.

Q: Do you have or teach acids and bases in this phase?

Miss G: “In Grades 4 to 6 we do not have acids and bases in our curriculum and I must say I do not know the reason for that because acids and bases are important groups.”

Q: Now, if you were to teach this topic how would you approach it?

Miss G: “I think *bekuzakufuneka sichaze ukuba yintoni i*-acid? *Yintoni i*-base? (I had to explain, what is an acid and what is a base?). And what were their characteristics? It is important for learners to understand these words as they have no meaning to them at all.”

“For example, acids and bases are used at home but *bona abantwana* (learners) they don’t know if this is an acid or a base. Therefore it is important to introduce this topic using daily examples first before you move to other examples.”

As far as the idea of using daily examples when teaching, Miss G also elaborated that teachers should try and accommodate learners’ views. But she highlighted the difficulties and the challenges that she normally encountered when doing so.

For example, she mentioned the fact that learners would always bring their cultural views in class and as a teacher it was very challenging for her to move her learners from that mind-set in order to understand the scientific facts. Finally, she was very certain of the fact that everyday knowledge of learners was important and teachers should always use it as their starting point when teaching.

4.5.2 Interview 2

This interview was held before conducting the research. As I mentioned in Chapter 3, the purpose of this interview was to get more insight into the importance and the value of this study from another teacher’s perspective. Thus, a male teacher from another school was interviewed. Since the first teacher was my colleague and teaching Grades 4 to 6, I thought that it was very important to get someone who teaches the same level with me (Grades 7 to 9) and someone who has more experience than me. In Chapter 3, I also gave the description of this teacher, his qualifications as well as his experience in teaching of science.

This interview took place on the 18th February 2011, at (13h00 – 13h30) at my school:

What was interesting about this teacher was that, as I was interviewing him he was talking about something he really loved doing. I noticed that he was passionate about science. I had

five focus questions for this interview but because of the interesting answers this teacher gave I also had some follow-up questions.

Questions and responses:

Q: For how many years have you been teaching Grade 7?

T: "This is my third year now; you know that Grade 7 is still primary so in most of my teaching years I have been teaching at high school (Grade 8-12)".

Q: So, if you have been teaching Grade 8 to 12 what approaches do you use inGrade 7?

T: "Mh… you know what Zuki, that has been one of my challenges. I struggle to come at their level when I am teaching. I am always tempted to go deeper than I am supposed to".

Q: Since you mentioned one of your challenges, what other challenges are you faced with?

T: "When I am teaching I am hoping that my learners will understand me and take whatever I am teaching outside the classroom. Meaning they should integrate and apply the knowledge they get to the outside world."

T: "But I always face the language barrier with my learners as they are *isiXhosa* speakers. Although I am trying hard to explain when teaching, I sometimes wish I could speak their language as well."

Q: How do you then make sure your learners understand the subject matter that you are teaching?

T: "Ah! Zuki: that is the most important part for me. You know asking questions while teaching, giving activities in between, that is what I do to make sure they are in the same pace with me. As a result, I make sure to give a test after each small topic I taught."

Q: How do you introduce lessons to your learners, especially new lessons?

T: "Ok, I always try to find something related to my learners' surroundings in order to trigger their interest, I use my learners' everyday knowledge".

T: “You know, everyday knowledge is vital for learners’ understanding of the subject matter. So, when I teach Natural Sciences I take everyday knowledge of learners as a starting point”.

Q: Ok, I hear your point, but can you elaborate more on that?

T: “Yes, you know when you are teaching science there is a need to link it to the experiences of learners, what they know. And then from there now you can move to complex ideas, which means, you move from simple to complex. In that way learners are able to appreciate science as a subject, because really science is part of their life”.

Q: Now, how do you approach the teaching of acids and bases?

This teacher replied that since there are many materials made from acids and bases with which learners interact in their everyday life, he always asked them to bring these materials to class. He also mentioned that he made sure he usedeveryday things when teaching this topic. He gave examples such as soaps, fertilisers, cool drinks and minerals.

This teacher also mentioned the challenge he has when teaching this topic. He said he finds it difficult to make his learners see the importance of acids and bases. Secondly, he said that he always struggles to keep this topic at the Grade 7 level.

In sum, from the above interviews it was clear that both these teachers saw the importance of using everyday knowledge and experiences of learners when teaching science. But, they also highlighted the challenges that were encountered when doing so. These two interviews made me realise the importance of planning and structuring my lessons for this research topic very carefully.

4.6 Observation of lessons

As mentioned in Chapter 3, the observation tool I chose for this study was adapted from the IQMS document for teachers. This tool has different categories which can help teachers assess their level of teaching and performing in their classrooms and in schools. The performance standards in this tool are clearly stated and these start from performance standard 1 to 6/7. Performance standard (1 to 4) is based on the classroom activities and from 5 upwards they are based on the teacher development and involvement in the school. Another

important aspect about this tool is that it varies from different post or position held by the teacher.

Performance Standard 1 looks at the creation of a positive learning environment; for example, an environment that includes learning space, learner involvement, discipline and diversity. Performance Standard 2 looks at the knowledge of curriculum and learning programmes; namely, knowledge of learning area, skills, goal setting and involvement in learning programmes. Performance Standard 3 looks at the lesson planning preparation and presentation. Lastly, Performance Standard 4 looks at the learner assessment and achievement.

Each Performance Standard has four levels of performance, strengths, recommendations and contextual factors. To my understanding if a teacher is observed while teaching and then given feedback as well asan opportunity to reflect, he or she will be able to know what were his/her strengths and weaknesses of that particular lesson. Moreover, recommendations could help the specific teacher to improve as well as understand the contextual factors of that particular class or school.

4.6.1 Lesson 1: Day 1

I divided the class randomly into groups of five learners per group and three groups had six learners per group. Because of the class number I had eight groups in total. I tried to have small numbers per group since I was avoiding chaos. Although the class was small, learners were able to face each other and work together.

In the first stage of this lesson, I wanted to find out how learners could help each other recognise the uses of everyday substances in their homes.To this end, I gave each group an activity which I extracted from questionnaire 2 (elicitation of prior everyday knowledge). My assumption was that this activity (Appendix G) could help learners to explain more and share their experiences about these substances.

Essentially, learners discussed their views about how each substance was used and for what each substance was used. I then instructed each group to select a group leader, a scriber and a presenter. Each group had to present their work to the whole class. Drawing from the results of questionnaire 2, the activity had all the familiar substances besides *ammonia* and *cream of*

tartar which were not in the list. I intended to show these two substances during practical activities.

This lesson was about 45minutes long. I gave learners 10 minutes for discussions and 20 minutes was spent on presentations and asking questions of the groups. The first five minutes I used to thank them for their time and I gave instructions about the lesson. I also explained to the learners as to why we had the two teachers with us. The final 10 minutes was used for the last activity of the day. After this activity, each group presented its findings to the class. Lastly, I asked each group to classify the substances in terms of how they felt and tasted when they use these substances from home. I told learners to have two groups of substances. Learners grouped the substances according to whether they were acids or bases.

Activity 1: Learners' responses:

Group	**Response to the activity**
1	This group showed they were not familiar with tartaric acid. They were able to find something for all other given substances.
2	This group, like group 1, did not know what tartaric acid was. They said that bicarbonate of soda was not only used for baking but also for sore stomach and tooth-ache. They claimed that to treat a sore stomach you mixed it with vinegar and it helped to reduce the pain, and for tooth-ache it was rubbed on the tooth as powder.
3	This group pointed out that tartaric acid is used to make ginger to give it an acidic taste. They also mentioned that milk was used for heart burn.
4	According to this group tartaric acid was used to make something grow. They could not give an example for their explanation. They also said that vinegar could be used to kill germs, and the example they gave wasto put a cup of vinegar to trap the smell of smoking or to remove fumes when painting the house. The class elaborated further saying that vinegar could reduce bad smells.
5	This group also did not know what tartaric acid was.
6	This group mentioned that vinegar reduced bad smells; and tartaric acid cleans surfaces.
7	This group was also not familiar with tartaric acid. They were however able to explain all other substances given to them.

8	This group was not familiar with tartaric acid, nor did they know *domestos* either. Their classmates asked them about the things they used to clean toilets in their homes. They came up with *Handy–Andy* and *Harpic*. Again, they were asked about the TV advert for *Domestos* and some remembered the advert. Regarding bicarbonate of soda, they said that it was used for underarms to reduce bad smells.

Examples of groups of substances: (classification)

Category 1:

Group	Acids	Bases
3	Bicarbonate of soda Vinegar Lemon juice Tomatoes Tartaric acid	Dish washing liquid *Handy–Andy* Bleach
4	*Hand –Andy* *Domestos* Window cleaner Powder soap Bleach	*Coca-cola* Grapes/ grape juice Milk

What came out from this activity was that although learners were actively involved and were participating well, most of them could not really understand the grouping of substances. Most learners formed groupings of substances based on whether a substance could be eaten or not.

The above two groups include the examples of what substances were listed. Some groups seemed to be just grouping the substances without having a specific reason. Group 6 and 7 are examples of this.

Category 2

Group	Acids	Bases
6	Vinegar Bleach *Handy–Andy* Tartaric acid	*Coca-cola* Dish washing liquid Bicarbonate of soda Tooth paste *Sta-soft*
7	Floor cleaner Vinegar Lemon juice Tooth paste *Stay–soft*	*Sunlight* dish washer *Handy-Andy* Bar soaps *Coca-cola* Tomatoes

This lesson was concluded by asking all the groups to make sure they completed the activity on grouping of substances since they were going to need that for the next lesson. For the next lesson the groups would need the resources that I had asked them to organise a week before. Therefore, I reminded the learners to bring the resources from home.

4.6.2 Lesson 2: Day 2

Lesson 2 was 50 minutes long and it was a lesson on practical activities. During the first 10 minutes I distributed the apparatus to all learners and each group had labelled tumblers. The class shared the resources they brought amongst themselves. The purpose of using tumblers instead of test tubes was to make learners feel as comfortable as possible.

Each group was given instructions to guide them. To ensure safety protocol was followed, I first explained the rules about working with chemicals. Although we were not working with dangerous apparatus I wanted learners to be clear about working with chemicals. The second step in this lesson was a work sheet (Appendix G) where groups had to write their findings (observation sheet). In this activity learners had to select leaders to ensure that all necessary steps were conducted. A scribe and a reporter representing the group also had to be selected. I could not help but notice that when selecting group leaders, learners voted in a democratic way selecting whom they thought most capable for the task.

I took learners step-by-step through the activity and this helped to ensure that all groups understood what was supposed to be done. Each group had to feel, taste with the tip of the tongue, and identify the colour of a particular substance. All the results had to be written down on the observation paper. After the activity was completed, all groups presented their findings to the whole class. I wrote the findings of each group on the board so that we could compare and discuss them.

To give an example I took the results of the two focus groups (4 and 8) as mentioned in Chapter 3.

Group 4:

Name of a substance	**Colour of a substance**	**How does it taste?**	**How does it feel?**
Solution of tartaric acid	No colour	Sour	Rough
Vinegar	Black	Sour	Smoother
Milk	White	Bit sweet	Soft
Grape juice	Clear	Sweet	Soft
Coca-cola	Black	Sweet	Rough
Handy-Andy	White	Sour	Soft
Bleach	No colour	Sour	Nasty
Tooth paste	White	Hot and sweet	Nasty
Bicarbonate of soda	White powder	Salty	Soft
Sunlight dish washing liquid	Green	Sour	Soft

Group 8:

Name of substance	**Colour of substance**	**How does it taste?**	**How does it feel?**
Solution of tartaric acid	no colour	sour	soft
Vinegar	black	sour	smooth
Milk	white	sweet	smooth
Grape juice	clear	sweet	watery
Coca-cola	black	sweet	soft
Handy-Andy	white	sour	smooth
Bleach	no colour	sour	smooth
Tooth paste	white	chilly	soft
Bicarbonate of soda	white powder	bitter	soft
Sunlight dish washing liquid	green	sour	smooth

As the learners were giving feedback to the entire class about their findings, I had to intervene so as to help them use the correct concepts or terms. As the results above show that some of the words used were not appropriate. Thus, where necessary I had to ask some groups with the help of the class to re-do the activity. In doing that I was trying to give them an opportunity to correct or rethink about the given answers.

The main theme of the next activity was the use of indicators. In this step I gave each group a half- cup of red cabbage indicator and a spoon. I told learners to put two fool spoons in each substance in front of them (each tumbler with the above substances). Learners wrote their observations down and reported them back in class.

In this lesson I believe that I could have explained about the red cabbage indicator in more detail. The prediction of what could happen when adding a red cabbage indicator in different substances could have been more interesting.

When learners noticed the colour changes in each substance they became clearer on which substances should be grouped together. This was based on lesson 1 as well as the discussions that took place in lesson 2. This lesson was concluded by asking learners to group the substances again using the discussions and the notes from the lesson. In doing this I asked learners to compare their grouping from lesson 1 with the one they would be doing after lesson 2. The reason for that was to make learners aware of their mistakes and to let them recognise the strategies that were supposed to be followed when classifying the substances given to them.

6.3 Lesson 3: Day 3

This lesson was also 50 minutes long, and I intended to do a recap of the previous lessons and then carry on by explaining the three concepts: acids, bases and indicators. I asked learners to list their new groups of substances. From that I noticed that there were still few learners who confused the following terms: sour, bitter, slimy and rough. One learner asked, *"What did we mean when we said vinegar is rough?"*

When I asked why he asked that question, he said that to him vinegar was just like water. From that question this learner gave me the opportunity to explain more about these concepts. To explain the concepts, I took vinegar and *Handy-Andy*and I asked him to come in front of the class. Fortunately he was not shy at all as he always loves to be the centre of attention in the class. I asked him to feel the vinegar with his fingers and do the same with *Handy-Andy*.
I then asked him to tell us the difference between these two substances. He said that *Handy-Andy* was a bit slimy while vinegar was watery. I also asked him to rub the vinegar between his fingers and he said that it felt a bit dry.

From there, I explained to the class that the reason why we use the term 'rough' is because of what happens when you rub vinegar between your fingers. I also went on asking learners what they thought would happen if they were to rub the liquid from a car battery between their fingers? And the whole class responded by saying "*Yho! Our fingers will burn*!" Again, I asked the reason for that, and they responded that "it is an acid". From there, I explained the

differences between ‘sour’ and ‘bitter’. We even used the *isiXhosa*words to explain these concepts. We used the following words to explain *imuncu* which means sour and *ikrakra* which means bitter.

Once the class understood these concepts then they could easily see their mistakes from the classification they had made earlier. During the discussions and explanations, learners were taking down some notes as I was writing short summaries on the chalkboard.

I then moved to the conceptsof acids and bases. I wrote the two concepts on the chalkboard and asked learners if they were familiar with them. The responses I received were as follows: *“acid is found in drinks”;* and *“acid is from the car battery*”.

But I noticed that nobody volunteered examples for bases. The next step I took was to explain to the learners the properties of acids and the properties of bases. After the explanation I gave learners a small activity where they had to group the substances using the two concepts acid and base. This activity was done in pairs since I wanted to see if the learners understood well or not.

From this activity I noticed some confusion again. For example,five pairs out of 19 offered the following response:

ACIDS	**BASES**
Coca-cola	Lemon juice
Vinegar	*Colgate*
Tartaric acid	*Handy-Andy*
Floor cleaner	*Domestos*

This was funny for me as their teacher because when these learners wrote the properties of the above substances they knew that the lemon juice was sour just like other acids and the floor cleaner is slimy and bitter. In this case I asked few learners (volunteers) to explain to the other learners why lemon juice is not a base. Learners explained this question by comparing the taste of a lemon juice with vinegar and tartaric acid. In this way we had a chance of recapping and exploring the understanding of acids and bases (properties).

As explained before, one might want to know if learners had ever tasted things like floor cleaner, because I knew that the substances we used in this study were not that dangerous to

human health if used correctly and with the right precautions. I asked learners to use the tips of their tongues to taste substances like floor cleaner and immediately to rinse their mouths with water.

Another confusion that came up for some learners was when they were asked to write the properties of acids and bases, but instead they gave examples. Observing these mistakes I asked volunteers to explain again to the entire class what is meant by properties. We had to give more examples using the individual characters in class. The next lesson was on the concept of neutralisation.

4.6.4 Lesson 4: Day 4

The next lesson was about conducting practical activities relating to neutralisation of acids and bases. Before starting this part, I asked learners if they had any questions. One learner asked what the difference between battery acid and *Coca-cola* was. Everybody laughed thinking that he was asking a stupid question. I calmed the class and asked them to listen to the responses that were going to come. The learners were amazed to discover that the so-called 'stupid' question asked by their classmate actually made a lot of sense.

That questiontook us back to the example of rubbing vinegar between the fingers and comparing it to rubbing the liquid acid from the car battery. I explained about weak acids and strong acids and I went further by explaining weak bases and strong bases. I could have used things like litmus papers and the use of a pH scale but my intention, especially with this age group of learners, was to useonly everyday materials and not laboratory resources. Hence, I also explained to the learners the use of indicators drawing from the practical activity we did using the red cabbage indicator.

Learners had fun with the neutralisation activity. In this case learners worked in their groups and I gave each group an observation paper to record their observations. I asked learners to mix equal quantities of the following substances: vinegar and bicarbonate of soda (measuring it with the tip of a teaspoon since it was in powder form); floor cleaner and vinegar; a solution of tartaric acid and bicarbonate of soda; *Coca-cola* and *Domestos*. The liquid substances were measured with clean cups (quarter cup of each substance). Accuracy in this type of activity could not be perfect, but at least learners knew that it was important to measure substances when working with these practical activities.

All the groups noticed that when they mixed a basicwith an acidic substance, bubbles appeared. Group 6 even mentioned that "*when [they] mixed vinegar and bicarbonate of soda it looked like it was going to explode*". At this stage I could have spoken about alkalinity and the formation of salts, but I was avoiding the use of concepts that would confuse learners. Such concepts could be introduced in Grade 8.

Some examples of responses from learners: (from groups 4 & 8)

Neutralisation of substances	
Group 4	Bicarbonate of soda and vinegar: it has a lot of bubbles all over the cup.
	Floor cleaner and vinegar: it has bubbles, they went up, it has a lot of acid coming up and it took time to stop.
	Tartaric acid and bicarbonate of soda: the bubbles did not want to stop; it grew sparkles.
	Coca-cola and *Domestos*: the *Coca-cola* changed colour completely to a yellow colour and there were bubbles.
Neutralisation of substances	
Group 8	Bicarbonate of soda and vinegar: a lot of acid is coming up and there are bubbles also.
	Floor cleaner and vinegar: it has bubbles, they went up and down.
	Tartaric acid and bicarbonate of soda: there was lot of acid and bubbles.
	Coca-cola and *Domestos*: the *Coca-cola* changed colour to a yellow colour and there were bubbles.

From the above examples it was easy for me to explain to learners that the bubbles were the sign of what reaction was taking place between an acid and a base. I explained to them that if the two substances (an acid and a base) are equally mixed that means that we are either neutralising an acid or a base. Depending on the concentration of these substances, after the process is complete, the mixture is no longer an acid or a base.

An aspect that I did not explain well to the learners was the fact that it is not necessarily the case that there will be bubbles every time an acid and a base are mixed. In this step one could

speak of the reaction of carbonates and hydroxides with acids. As already mentioned, it was necessary for the study to stick to the level of the learners so as not to confuse them.

Learners wanted to know what would happen if they added a red cabbage indicator into the mixtures; would it change colour or not? This was a thought-provoking question. I asked learners what their prediction was, and what they thought would happen. One learner was sure that there would be a change of colour in the mixtures, and subsequently an argument ensued because one group of learners (group 8) argued that there could not be a change of colour if the mixtures were neutral.

I asked this group to explain further to the entire class. One boy from the group said "*Mam, if a substance is neutral it is neither a base nor an acid*". He gave the example of water, saying that if we were to mix water with the red cabbage indicator there would be no colour change. I then asked the learners to add the red cabbage indicator in each mixture.

According to the results they had with the mixture of *Domestos* and *Coca-cola*, there was a slight change of colour as it became lighter; while the other mixtures showed no change. I tried to explain to learners that it could be because *Domestos* was a stronger base than *Coca-cola*. It did not mean that the solution was more basic but it became lighter. Again at this point I could have spoken about the concept of concentration.

I concluded the lesson by asking the learners to go through their notes preparing for the test they were going to write the next day. I gave them some notes to extend their knowledge on acids and bases. The notes included everyday substances with scientific names (types of acids found in everyday substances like fruit); including the use of a pH scale and other indicators. Although I did not teach the learners about the pH scale, my interest was to show learners that there was more to this topic than what we did and the notes were going to help them to prepare for the test on the next day.

4.6.5 The test: Day 5

The test (Appendix G) was based on the topics taught during these lessons and it was out of 30 marks. This test was meant to assess the learners' understanding of acids and bases. My assumption was that if my learners passed the test that would indicate that they had

understood the lessons. Again, in this test I looked at how learners were writing, giving explanations to the questions I asked them.

The test was in four sections. Section 1: I asked learners to group different substances (acidic and basic) into acids and bases. Most learners got full marks in this section and very few were still confusing the two substances.

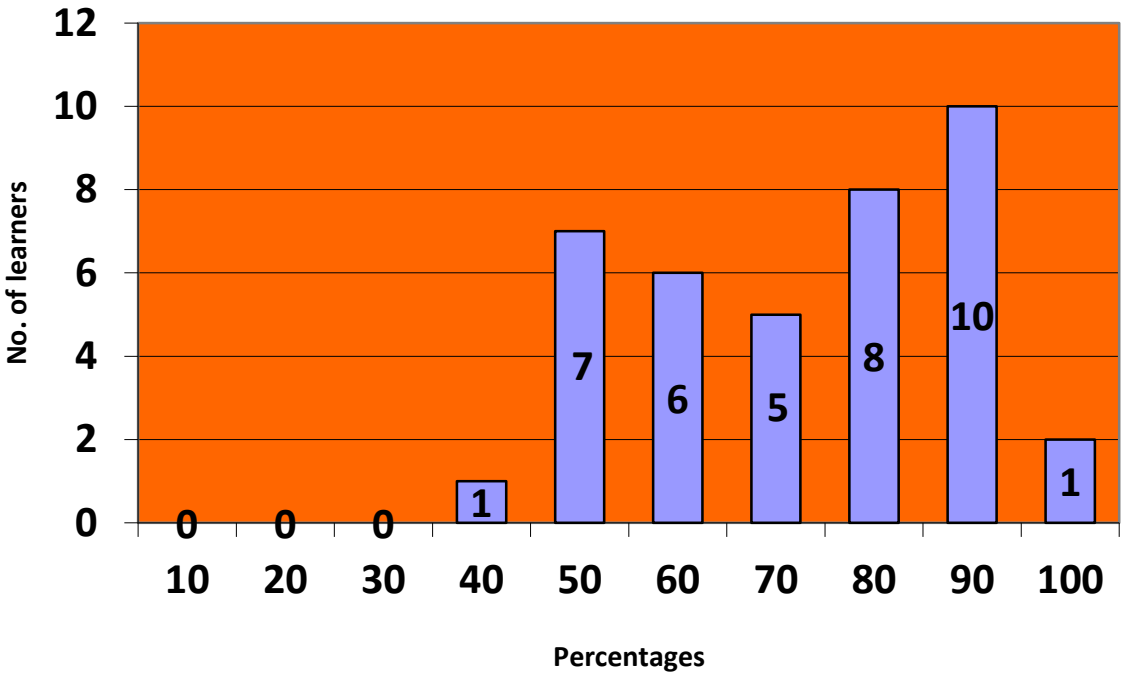
Section 2: learners had to fill the missing words.More than 80% of learners got this section as well. Section 3 was based on defining concepts, and more that 60% of learners got this section perfectly correct but I was still not happy about how other learners were explaining the concepts.

For example, instead of explaining the concepts they gave examples. The last section asked learners to give examples of acids, bases and indicators. Almost all learners got this section but there were still a few learners who continued to confuse these terms.

From the test, three learners obtained more than 95%; one learner had 100%; one learner got under 50% and six learners got under 60%. The rest of the class got between 60% and 90%.

Overall, I was happy about how learners performed in this test although there were remained concerns to be addressed. If given another opportunity with these learners I would definitely go through the test with them so that I could clear some of their misconceptions.

Graph 3: Analysis of test results



4.6.6 Reflections and discussions with the participant observers

With the help of the observation tool, the two participant observers were able to take notes while I was teaching and this helped them a lot during our reflections and discussions. I could see that while we were watching the videotaped lessons, they kept on referring to their notes. They both agreed on the following comments:

Contextual factors:

- The space was limited, but the class was well-organised.
- There were too many groups but this was good for behaviour/discipline purposes.
- Some learners sat with their backs facing the board (they had to turn every now and then in order to listen to the teacher and write notes).
- Learners were repeatedly asking questions in *isiXhosa* (mother tongue).

Strengths:

- Groups were kept small which is good for discipline.
- Learners were active throughout the lessons.
- Learners' prior everyday knowledge was elicited from known to unknown.

- Learners were constantly reminded about the task at hand.
- Lesson planning was well structured and continuous.
- Asking questions continuously made learners attentive.
- There were good ways of letting learners differentiate between acids and bases without them being aware of it.
- Due to the style of teaching most of the time the learners reached conclusions independently.
- The use of a chalkboard was good.
- This good way of introducing new concepts to learners was conducted very well.

During the discussions the following suggestions came up

- When giving instructions I should make at least one example for learners.
- Since I had too many groups I should have had a demonstration kit (apparatus) as well in order to take learners through each practical activity.
- Again, the technology teacher commented on a number of substances I used (too many substances for learners which could lead to restlessness).
- When teaching or explaining something, they suggested that I must avoid giving too much information to learners at a time and I should ask questions in between as this could help learners to pay more attention.
- The observers also suggested that to avoid learners being left out when asking questions I should give each group a question or ask groups to help others when necessary.

My argument on the use of different substances was that I wanted learners to explore as many substances as they could.At the same time I was wary of the confusion and the restlessness that could take place. To avoid confusion I asked each learner to take part in their groups. That means in each group each learner had a responsibility. From my point of view, these lessons have been successful.

4.6.7 Focus group interviews

For focus group interviews as mentioned in Chapter 3, I chose two groups. During the lessons I noticed that group 4 and 8 were active and participating well in class. In group 4 there were four girls and two boys while in group 8 there were five boys and one girl. I also noticed that

the boys were overpowering the girl and this was the same in group 4 where the girls were more active than the two boys. The questions were based on the whole process of the research, the learners' benefits and the learners' interests on the topic (Appendix E).

Responses from these two groups were as follows:

Group 4

At first I asked the learners to comment on the whole process. According to this group, the whole process was interesting and they even mentioned that it was good to know about new things. These learners carried on by saying that they liked the practical activities more because they were able to work with apparatus in class for the first time. Furthermore, they concluded by saying that from there on they would never take things for granted.

This group also mentioned things with which they did not feel comfortable. They said they were not comfortable with the camera on them and that I should only have used a tape recorder. Secondly, they wished that they were given an opportunity to choose their own groups.

Group 8

This group felt that it was nice to work with different substances and also to learn how important they were. They used words such as "*these activities were awesome and wonderful*". The section on neutralisation was most interesting for this group. They even mentioned that they wish they could be taught like that all the time as they had gained more knowledge on acids and bases. The fact that they could see what they were talking about was also interesting. These learners gave an example of vinegar with bicarbonate of soda. In contrast to group 4, the fact that there was a video camera in class made these learners more excited.

4.7 Conclusion

This chapter presented the findings from data gathering tools. From analysing the questionnaires it was clear that learners had prior everyday knowledge and experiences about acids and bases. And it is up to teachers to take advantage of this knowledge in order for their learners to understand scientific concepts better. It was also clear that learners were

comfortable throughout these activities since they were using familiar resources. The different themes and findings that emerged from this data will be further discussed in the next chapter.

CHAPTER FIVE

ANALYSIS OF RESULTS & DISCUSSION OF FINDINGS

5.1 Introduction

This chapter discusses the emerged themes and findings from this study. Three Natural Sciences textbooks together with the RNCS document were analysed with reference to how they presented the topic on acids and bases.

Interviews were held with two teachers in order to verify the importance of this study and to find out the strategies they used when teaching acids and bases in their classes.

The questionnaires were used to profile learners and to elicit their prior everyday knowledge on acids and bases. As mentioned in Chapter 3, the above techniques formed the base line data of this study and the following techniques formed the main data.

Observation of lessons also took place in order to find out what themes would emerge when using everyday resources during the teaching and learning of acids and bases. Reflections and discussions with the two participant observers as well as focus group interviews with the two groups of learners took place to identify the strengths or the benefits and weaknesses of this approach. Lastly, recommendations and conclusion based on the study are discussed and outlined.

Some of the responses and themes that emerged were collated and presented in tables and where appropriate were presented in short summaries or discussions (see Chapter 4). It was not always possible to present the percentages of what emerged or what all the learners said, but where necessary (where most learners had the same view point) the two focus groups were used as examples. The themes that follow were noted from each of the above stages in Chapter 4 and will be discussed further with reference to the relevant literature.

a. How did the selected grade 7 Natural Sciences textbooks presented the topic of acids and bases? Although textbooks 1 and 2 do have acids and bases and useeveryday resources as examples, these textbooks do not give guidance as to how teachers should go about teaching this topic.

b. The RNCS document promoted the use of everyday examples and resources when teaching science but it then became daunting for teachers as this document were not clear as to where teachers should start teaching acids and bases. It just said 'classification of substances'. It was not clear as to which substances should be taught nor was it clear how teachers should go about teaching this topic.

c. During the interviews the intermediate phase teacher made it clear that in Grades 4 to 6 they did not have acids and bases. The senior phase teacher stated that since he had to teach Grade 7 to 9 he combined his Natural Sciences lessons and in that way he believed that he covered acids and bases across the phase.

d. The questionnaires (learner profile & learners' prior everyday knowledge in acids and bases). Learners' profile had provided a significant data in this study. 80% of learners' parents were domestic workers (or worked as cleaners). This is relevant to this study as they came across acids and bases in everyday life.

e. Judging by results of the questionnaires, it was evident that learners had their own everyday knowledge and experiences of acids and bases. Their attitudes and beliefs were taken into consideration. Although learners were familiar with most substances,it was observed that some of them came up with certain concepts.

f. During observations, it was clear that learners were participating very well as they asked questions in order to make sense of concepts and to understand them better.

g. Also, during this process it was observed how positive reinforcement through discussions, debates and interviews was created.

h. Language proficiency, although not the interest of this study, was an emergent theme as well.

Moreover, the emerging themes are also discussed with the view that each theme tries to answer the three main questions of this study as highlighted in Chapter 1.

- Does the socio-cultural background of learners influence their prior everyday knowledge and experiences of acids and bases?

- Does elicitation and integration of learners' prior everyday knowledge and experiences facilitate or constrain learning of scientific concepts on acids and bases?

- Does engaging learners in practical activities using everyday substances enhance or constrain their conceptual development and understanding of acids and bases?

5.2 Discussion of findings: Base line data

5.2.1 Presentation of acids and bases in textbooks

Acids and bases are almost everywhere. They are used daily by many people and some textbooks do take that into consideration. But the fact still remains that some teachers are not well equipped to use textbooks appropriately. This might impact negatively on learners as some of them might not be familiar with the examples in those textbooks.

Another aspect concerning textbooks is that some do not cater for all learners. For example, learners might have different experiences when it comes to acids and bases and hence teachers need to accommodate those differences and experiences. Teachers need to be able to go beyond what the textbook says in order to assist learners to gain a better understanding. According to Beard and Wilson (2006, p.21), experience is meaningful engagement with the environment in which we use our previous knowledge to bring new meanings to interactions. For example, if learners are not given opportunities to explore their knowledge, depending solely on textbooks might confuse their understanding of the subject at hand. Hence it is wise for teachers to supplement textbooks and develop their own teaching and learning support materials (Czerniewicz, Murray & Probyn, 2000) that are relevant to learners' everyday life experiences (Stears, Malcolm & Kowlas, 2003).

Lastly, the three textbooks I analysed do not guide teachers in how to teach acids and bases nor do they provide teachers with teaching strategies. For this reason, it is very important for teachers to design their own lesson plans or teaching modules taking into consideration the background of the learners.

Below, I look at how the data from the questionnaires contributed to this study.

5.2.2 Data from questionnaires

The main purpose of questionnaires in this study was to investigate learners' parental support system (learners' socio-economic background) and to investigate their prior everyday knowledge and experiences on acids and bases (Sections 4.4.1 & 4.4.2). As mentioned in Chapter 4, it emerged from this study that most learners lived with their parents (about 90%); and very few lived with their relatives and single parents (about 10%) hence it was assumed that the majority of learners have parental support.

From the learner profile questionnaire it has been revealed that almost all parents (95%) in this class are working and this was another sign of a good support system for learners as they could be financially supported. Although these parents were working, however, about 80% of them were domestic workers and as mentioned in Chapter 4 (Table 7) this is significant to my study.

As already stated in section 2.6, acids and bases are a good starting point and foundation to teach and introduce chemistry to learners. Chemistry can be easily linked to everyday phenomena. For example, most acids and bases from home are used for either cooking or cleaning, in the kitchen or in the bathroom. Hence, the 80% of parents in this class could be really good supporters for their children when it comes to this study. Oloruntegbe and Ikpe (2011) in their study argue that some teachers do not encourage learners to connect their daily activities with classroom science and thus it has been found to be difficult for learners to develop scientific concepts with the help of their everyday life experiences.

This study tries to close the gap between everyday life experiences of learners and classroom science as proposed by Rennie (2011). In so doing, learners' prior everyday knowledge has been assessed using questionnaires in order to plan the study effectively and appropriately (Chapters 3 & 4). Learners in this study indicated that they were familiar with most substances which were presented to them in the questionnaire and some learners in the open-ended questions did show an understanding of other substances that could be associated with acids and bases (Sections 4.4.1 & 4.4.2).

According to Jarvis et al. (2003:56), learners can actively construct their own experiences either from home or their surroundings (Section 2.3). Hence this study has assumed that

learners who help with certain chores from home would interact better and understand concepts better irrespective of their socio-economic status (Oloruntegbe & Ikpe, 2011).

For this reason, Leach and Scott (2003) have also looked at the necessity of science teaching to interact with the knowledge that learners bring to a given teaching situation. Consequently, I will look at how the integration of learners' prior everyday knowledge has benefited or constrained the Grade 7 learners in this study.

5.3 Main data

5.3.1 Eliciting learners' prior everyday knowledge

The discussion refers to 4.6 and 5.1 (f & g)

In this study different strategies or methods of teaching were combined to promote learners' effectiveness so as to increase their degree of knowledge. Learners worked individually, in pairs and in groups. It has been stated that group activities are time consuming but when group members work together, it is of benefit to learners to share their experiences (Euvrard & Wilmot, 2000). Salvin (2004) argues further that group norms should support the performance of the tasks where all individuals would cooperate and help the group to succeed and improve their performance.

This helped me as a teacher to observe how each learner performed and participated during these lessons. In the first activity (Section 4.6.1), learners were asked to discuss and share their opinions about daily substances used at home. Thereafter, each group had to present their results to the whole class. Learners demonstrated an understanding of how most substances were used and why were they used (Section 4.6.1 outlines the learners' responses).

Although these learners were familiar with the substances (acids and bases) given to them they could not give a proper scientific explanation as to why these substances were used. There was a lack of prior scientific knowledge. During the presentations, one could clearly observe that these learners still needed some introduction and guidance into scientific concepts.

On the other hand, when learners were asked to use their knowledge in grouping the substances they analysed, and although they tried, it was also clear that even in this part of the activity they were not sure what skill to use in order to identify the groups. The great aspect for me as a teacher was the fact that the Grade 7 learners were familiar with most of the substances which were going to be used for this study. At some point I was able to evaluate learners' prior knowledge which was going to be the base for my teaching.

O'Donoghue (2006: 2) states thatat school every child is confronted with what s/he knows already and what the school offers (social learning and the needs of curriculum). Thus, in this case prior knowledge is vital for this study (Section 2.4). For instance, in activity1 learners exposed the level of their prior everyday knowledge and also the missing gaps in their prior everyday knowledge were noted.

The next section discusses how learners' prior knowledge and engaging in practical activities has enabled or constrained them in understanding scientific concepts on acids and bases.

5.3.2 Understanding the concepts and engaging in practical activities

The main concepts in this study were acids, bases, neutral substances and neutralisation, indicators and learners had to be able to classify substances using their properties. As the teacher I did not worry about the fact that I had to introduce unknown substances to learners which could be a hindering factor.

My learners already knew most substances and hence I had to move further by identifying the properties of the two groups (acids and bases). In my opinion and assumption there is no better way to teach the above concepts than to involve learners in practical activities using everyday materials (Section 4.6.2). I agree with Roschelle (2003) who argues that prior knowledge forces a theoretical shift to viewing learning as conceptual change.

Learners thus manipulated the resources in order to understand the concepts or to shift their understanding of these concepts (from known to unknown). I believe that, since it was the first time these learners were taught about this topic, new concepts such as acids, bases, neutralisation and indicators, created the shift from context to content.

To verify this factor, during an informal conversation between myself and the Grade 4–6 teacher, the teacher brought up the fact that there were not many topics about which to conduct practical activities in the phase she taught. Furthermore, the RNCS document has confirmed that there is no teaching of acids and bases in the intermediate phase.

The practical activities helped learners to identify the appropriate characteristics of the two substances (acids and bases). The fact that most learners had some experience of using these substances from home and that we went even further by manipulating them in class, made it easier for me to explain. Woodley (2009: 49) argues that the purpose of a good quality practical task is to help learners to develop important skills, to help them understand the process of scientific investigation and to develop their understanding of concepts.

In this study, learners were given opportunities to explore the everyday material which they brought to class. Johnstone (2010:25) in his model suggests that, "we should begin where students are with their interests and experiences, and lead them to discovering new ideas among the familiar". He further argues that an obvious starting point is in organic chemistry, with gasoline, camping gas, food, clothing, plastics and drinks and so much more that is familiar.

It is for this reason, that in this study, learners had to observe, think critically and compare the everyday substances they brought. These practical activities were 'hands on', 'minds on' activities which prompted the thinking of learners about the world in which they live, especially about substances they use at home (Woodley, 2009).

Millar (2004) argues further by saying that real effective practical activities enable students to build a bridge between what they can see and handle (hands-on) and scientific ideas that account for their observations (brains-on). Making these connections is challenging, so practical activities that make the above links explicit are more likely to be successful. For example, the use of the everyday materials in this study helped learners to feel comfortable and work without being afraid of breaking substances. Moreover, learners had the opportunity to ask questions (Sections 4.6.4 & 4.6.5) and argue about some of the things they observed during these practical activities. This helped them to make sense of the new knowledge and to understand the subject matter better.

During these practical activities, learners were also afforded an opportunity to make predictions. For example, during lesson 4 (Section 4.6.5) learners argued about colour changes in neutral substances. Through these discussions I asked learners to predict what would happen if they poured an indicator in each mixture? One leaner even gave an explanation as to why there would be no colour change in the mixtures (Section 4.6.5). Maselwa and Ngcoza (2003) support the Predict-Explain-Explore-Observe-Explain (PEEOE) approach as it helps learners to give explanations for their actions. I am in favour of this approach too and in future I will try it out more with my learners.

Lesson 4 (day 4) was the last actual teaching day but I had to give an assessment task to verify learners' level of understanding after teaching acids and bases to them.

According to the Curriculum (2005) assessment guidelines for Natural Sciences, tests could be used for summative or formative purpose. These usually consist of a range of questions. In this study, I gave learners an objective test which included various types of questions like recalling information, analysis and checking information. In the test learners had to explain concepts based on acids and bases and provide concepts for given explanations. My aim was to find out how much learners gained from my teaching and what understanding they had about acids and bases after the whole process. From the test (Section 4.6.5), I realised that I had few learners who still needed clarification of concepts as they were confusing some of the concepts.

If I was afforded another opportunity to teach this Grade 7 class, I would make sure to teach bases again. I realised that there were still a few learners who were confusing this concept. For example, in Chapter 4 lesson 3, learners were not able to explain what they already knew about bases but they came with more explanations for acids. However, this suggests that this concept is not commonly used in the community.

Another important point to note is that in the test some learners were still making the mistake of giving examples instead of listing properties. Such factors needed to be ironed out in time and fortunately I did give some feedback to learners about the test.

5.3.3 Reflections, discussions and focus group interviews

During stimulated recall discussions with the two participant observers, strengths and weaknesses of this study were illuminated (Section 4.6.6) and suggestions were made. As I have said in section 5.3.2, if I could be given another opportunity to do this study again, there would be some changes in how I would conduct it. For example, I think when working with learners it is very important to lead them through when doing practical activities especially with the age group with which I was working. Having the model kit for practical activities was a very good suggestion. Asking questions from groups instead of individuals (mixing the two) was another excellent suggestion and in that way I assumed all learners could have felt included in the lesson.

The focus group interviews have also highlighted some important concerns. The two groups I interviewed mentioned that they had fun with practical activities and learned a lot from these activities. As their teacher I assumed that the practical activities that were conducted in this class had a purpose, they were not just for fun or enjoyment. Roberts (2004) argues that practical activities could be about solving problems, to create new knowledge, to answer empirical questions and to make something or to make that something work. For instance, in this study learners had to understand the properties of acids and bases. Learners had to understand or at least have some idea of neutralisation and they had to know about indicators. Hence it was worth having practical activities in this study.

One group (group 4) pointed out that they were not comfortable with the video camera in class while group 8 had no problem with the video camera (Section 4.6.7). This alone shows that learners are not the same and they think differently from one another and that should be factored in as part of an equation when working with them.

In addition, during interviews and sometimes during class, learners were explaining themselves in their mother tongue (*isiXhosa*). This occurred especially when learners were trying to make a point or clarify something. The use of hands (gestures) when they spoke and the use of sentences in *isiXhosa* when they were writing (Section 4.4.2) was another sign of the learners' deficiency in English which is the LoLT at my school. However, this study was not investigating the language problem encountered by learners during science lessons, but since such related problems came up this could be an area for future research.

I also noted that learners had a problem confusing concepts or terms, and spelling problems were also encountered. Hence it is important to consider different strategies that could be used to help learners not to confuse their daily language with scientific language. Consequently, teachers themselves need to find ways to minimise language problems in their science classes.

5.4 Limitations of the study

In this study I was unable to explore concepts such as 'concentration of substances' and 'alkaline' limited further understanding and development of new knowledge in this study. More research or investigation based on acidic and basic substances should have been given to extend learners' prior knowledge (for example the use of library books; the internet and maybe examples of animals with acidic and basic fluids – evidenced by bee and wasp stings respectively).

The language factor remains a problem and there is a limitation where learners are second language speakers of the language of teaching and learning (LoLT). Some concepts such as equal quantities instead of the concept of concentration were used since it was considered to be difficult to explain and use them in that grade. In retrospect, I assumed that learners at Grade 7 would have difficulty understanding such concepts.

5.5 Recommendations

A further study into the influence of learners' prior everyday knowledge and experiences in acids and bases is recommended. Such a study should be done concurrently with investigating teachers' prior everyday knowledge and experiences in acids and bases. If teachers are to design appropriate lessons or modules for their learners they need to be well prepared for the shortcomings during their science lessons.

Although it would be time-consuming, further study on the integration of prior everyday knowledge of learners in acids and bases is recommended and should be done concurrently with the shift from everyday resources to laboratory resources. It would be interesting to observe learners' attitudes towards the two.

Learners need to be challenged with assignments, projects or tasks that will test their prior everyday experiences in science.

I also recommend a study based on teachers' attitudes towards practical activities using easily accessible resources in their science classrooms.

Learners should be encouraged to ask questions, to be involved in discussions and debates so as to improve their language proficiency in science classrooms. This could be done in conjunction with group activities, working in pairs or individual presentations in class. This could also improve learners' confidence and participation in science lessons. Through discussions by learners during this study another opportunity for future research was observed: how to enhance learner talk and argumentation during the science lessons?

Again, it would be of benefit if workshops could be conducted for parents too, in order to motivate them to support and involve their children in household activities (chores like cleaning, washing pets, and gardening) as it is highlighted by Oloruntegbe and Ikpe (2011) in their study on eco-cultural factors. These kinds of activities could help learners understand how things work (socio-cultural issues and science).

5.6 Conclusion

Acids and bases are one of the important topics under the theme of Matter and Materials. As mentioned in Section 2.6 & 5.2.2, this topic can be of use to introduce chemistry to primary learners. The link of everyday resources in this study motivated learners to want to know more about their surroundings and to want to learn more about science.

To me and the two participant observers, this study was an eye opener. The themes that emerged in this study have pointed me in a new direction in my teaching career. How teachers elicit and integrate learners' everyday knowledge in teaching science is very important. However, the language issue that emerged from this study could be considered as an area for future research since it was beyond the scope of this study.

The next chapter will explore the evaluation of the study and the journey of my Master's course. The overview of the Master's programme, coursework and the research experience are discussed in this chapter as well.

CHAPTER SIX

MY PERSONAL REFLECTIONS & CONCLUSION

6.1 Introduction

This chapter explores my journey with reference to the experiences gained during the period when I wasdoing the Master's programme. With a short summary it will firstly look at the evaluation of this study and proceed to an overview of the entire programme. It also exposes the frustrations and pleasures along this route to my final destination. Lastly, it highlights the research process and concludes with a reflection on how the programme has transformed my attitude towards life including my professional responsibilities.

6.2 Evaluation of the study

As explained in Chapter 1, the main goal of this study was to investigate the benefits of eliciting and integrating learners' prior everyday knowledge and experiences when teaching acids and bases in Grade 7. Followed by the three focus questions of this study:

- Does the socio-cultural background of learners influence their prior everyday knowledge and experiences of acids and bases?
- Does elicitation and integration of learners' prior everyday knowledge and experiences facilitate or constrain learning of scientific concepts on acids and bases?
- Does engaging learners in practical activities using everyday substances enhance or constrain their conceptual development and understanding of acids and bases?

In response to whether the above goal has been achieved or not, I will start by giving a brief summary of how each question was answered in this study.

Questionnaires, discussions and interviews were used to elicit learners' prior everyday knowledge. These techniques have exposed learners' understanding of acids and bases, how they are used, and what they are used for. Furthermore, everyday examples of acids and bases have also helped learners do differentiate and classify acids and bases using their

characteristics. Stears, Malcolm and Kowlas (2003) in their study revealed that the use of everyday knowledge in the science classroom increases the levels of engagement of learners, and that learners enjoyed making links between their different experiences when curriculum is designed to facilitate such links.

Secondly, the use of everyday materials during practical activities encouraged learners to ask questions (Section 4.6.5 & 5.3.2) and hence to understand the concepts better. Practical activities proved to be more successful in this study and that could be due to the fact that learners were comfortable and familiar with the substances used.

Irrespective of learners' background, this study has shown that learners with parents that are domestic workers and learners that help with chores at home had more opportunity to engage in this study since they were familiar with substances that were used (Oloruntegbe & Ikpe, 2011). Since the study was designed to facilitate the integration of everyday knowledge and experiences of learners (Stears et al., 2003) and has managed to do so, I believe that this study can be considered as trustworthy.

6.3 An overview of this Master's course

A human being is not attaining his/her full height until he/she is educated (Mann, 2011). In this course I found out that the more I was introduced to certain aspects of research the better I understood the purpose of why there was the need to research our field of professionalism (in this case the science curriculum). In the first year (2010), the course started with a lot of assignments which were meant to make us (students) understand the process of research. At the same time during the first year we were busy with our proposals for our individual studies.

The main thing I liked about the first year was the fact that while we were busy with our proposals we had the advantage of understanding exactly what was expected when doing the actual research in the following year (2011). I found the opportunity very enlightening especially as a first time or novice researcher.

The research design course, and the experienced students that were invited by our supervisors, were very helpful in terms of the whole process. The highlight of my first year was the fact that as a result of hard work and through reflective criticism my proposal was approved by the Education Higher Degrees Committee (EHDC). In that way I was able to start my actual

research in 2011. I must say the small scale research (pilot study) that I conducted in 2010 was an informative trial and error process for my actual research in 2011. The contact sessions with my supervisor helped and encouraged me a lot in this journey and the first year was full of rewards.

6.4 My research experience

During this process there were times where I felt I should just give up. As a mother, a wife, a teacher and a Natural Sciences PGCE part-time lecturer, time management was a challenging factor for me in this process. The motivation was the fact that I managed to gather my data on time and the support and encouragement I received from my family, my supervisor and my fellow students was what kept me going.

My learners, participant observers and other participants in this study were cooperative and did not give me any problems. As this is my first research I learned a lot: the need to keep time schedules, the need to analyse data immediately after gathering it is important so as to be able to validate your findings. To analyse data straight away as a researcher could make things easier since the whole process is still fresh in the mindsof both researcher and participants (easy to verify mistakes or problems). I think the heart of the research is the data and its analysis for the reason that it could help a researcher refine literature and discussions.

The fact that I met many people because of this research has been a great joy for me. Through this study I shared views, ideas and asked questions related to my study in order to verify my research topic. I am delighted with the fact that so many researchers had highlighted some of the findings I mentioned in this study in their studies as well (Section 2.6).

6.5 Conclusion

The course work and this thesis have been equally enriching and educational. This journey has fulfilled my first step towards my dreams of playing a valuable role as a teacher and in the community. From this study it is clear that there is more than what we take for granted as teachers when we work with learners in our classrooms. For example, this study has revealed that questions from learners need to be considered during lessons that could promote a sense of understanding about the subject at hand.

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APPENDICES:

Appendix A

The District Director

Regional Education Department

Grahamstown

6139

Dear Sir/Madam

REQUEST FOR CONDUCTING A RESEARCH AT NTABA MARIA PRIMARY SCHOOL WITH A GRADE 7 CLASS.

I am a grade (7-9) science teacher at the above school and currently enrolled for a Masters degree in science Education at Rhodes University.

As a science teacher I am interested at how science educators can improve their teaching methods for the betterment of learners and their teaching environments. Therefore for the above reason I am currently looking and investigating the importance of using learners' prior every-day knowledge and experiences in science classes to develop or improve learners' conceptual understanding in acids and bases.

My request is that, if you are in agreement with this request, this research will thus comprise of four stages. Firstly, I would like to do baseline interviews with two science teachers the intermediate and the senior phase teacher. Secondly, I'm hoping to give questionnaires to the grade 7 class which I intend to work with for this study to evaluate their understanding in acids and bases. Thereafter, I will thus observe, record discussions and videotape NS lessons on acids and bases in a grade 7 class. Lastly, in order to reflect towards the whole process I will do interviews with teachers and learners after observing this topic. This research will as from Jan. 2011 to Dec. 2011.

I will be very happy if you consider my request and look forward to hear from you. I can be reached on this e-mail (g08k5463@ru.ac.za) school number is 046-6362937 or 0840387368.

NOTE: My supervisor is Dr. K. M. Ngcoza at Rhodes University.

046 6038883 OR (k.ngcoza@ru.ac.za)

Yours Sincerely,

Zukiswa Kuhlane.

Province of the
EASTERN CAPE
DEPARTMENT OF EDUCATION

OFFICE OF THE DISTRICT DIRECTOR

St. Aidens Building, cnr St. Aidens & Milner Street, Grahamstown 6139 • Private Bag X1031 • Grahamstown • 6140
• REPUBLIC OF SOUTH AFRICA • Tel: 046 - 603 3299 • Fax: 046 – 603 3287 • Website: ecdoe.gov.za
e-mail: atfetsha@webmail.co.za

Enquiries: A T FETSHA

27 January 2012

TO WHOM IT MAY CONCERN

Permission is herby granted to Ms Zukiswa Kuhlane to conduct research at Ntaba Maria Primary School (Grade 7) for her Masters degree in Science Education.

Should you have any queries, please do not hesitate to contact the writer hereof.

Yours faithfully

A T FETSHA
DISTRICT DIRECTOR
GRAHAMSTOWN DISTRICT OFFICE

Appendix B

The Principal

Ntaba Maria Primary School

Grahamstown

6139

Dear Sir/Madam

REQUEST FOR CONDUCTING A RESEARCH AT NTABA MARIA PRIMARY SCHOOL WITH A GRADE 7 CLASS.

I am a grade (7-9) science teacher at the above school and currently enrolled for a Masters degree in science Education at Rhodes University.

As a science teacher I am interested at how science educators can improve their teaching methods for the betterment of learners and their teaching environments. Therefore for the above reason I am currently looking and investigating the importance of using learners' prior every-day knowledge and experiences in science classes to develop or improve learners' conceptual understanding in acids and bases.

My request is that, if you are in agreement with this request, this research will thus comprise of four stages. Firstly, I would like to do baseline interviews with two science teachers the intermediate and the senior phase teacher. Secondly, I'm hoping to give questionnaires to the grade 7 class which I intend to work with for this study to evaluate their understanding in acids and bases. Thereafter, I will then observe, record discussions and videotape NS lessons on acids and bases in a grade 7 class. Lastly, in order to reflect towards the whole process I will do interviews with teachers and learners after observing this topic. This research will as from Jan. 2011 to Dec. 2011.

I will be very happy if you consider my request and look forward to hear from you. I can be reached on this e-mail (g08k5463@ru.ac.za) school number is 046-6362937 or 0840387368.

NOTE: My supervisor is Dr. K. M. Ngcoza at Rhodes University

046 60383883 OR (k.ngcoza@ru.ac.za)

Yours Sincerely,

Zukiswa Kuhlane

CONSENT FORM

I Rodney Schaepers in my capacity as a the Principal of this school hereby fully grant permission to **Zukiswa Kuhlane** in her capability as an MEd student at Rhodes University to conduct a research at this school Ntab. Maria as outlined in the above letter. Both parties had an understanding that all participants should be given a right to withdraw at any time without an explanation.

Rodney Schaepers
Principal (full name)

NTABA MARIA SCHOOL
PRINCIPAL
DATE
MR R SCHAEPERS

14 June 2011
Signature and date

ZUKISWA KUHLANE
Student's full name

14/06/2011
Signature and date

Appendix C

Ntaba Maria Primary School
Grahamstown
6139
03 March 2011

MzaliObekekileyo,

Isicelosokusebenzangomntwanawakhokuphandoendilwenzayo;

NdinguMrs.Kuhlaneofundisaumntwanawakhongezenzululwazi (Natural Sciences) kwesisikolosingentla.Ndifundisakwisigaba (7 to 9). NdikwanguyenomfundikwiDyunivesitiiRhodes.Ngokokendicelaukusebenzango mntwanawakhokuphandoendilwenzayomalunganokuphuhlisaindlealaabasebenza ngayootitshalaezikolweni.Oluphandondizakulenzakwisigabasesixhenxe (grade 7).

Ndiyathembisaukubaakukhobungozikoluphandokwayeluzakumncedaumntwana kananjaloabenolwazioluphangaleleyo.Ukubaunemibuzomalunganokundicelauku bauzeaphaesikolweniokanyeunditsaleleapahakulenombolo: 084 038 7368.

Enkosi.

Ozithobileyo,

Mrs.Z. KUHLANE

Ukubauyavumandicelaundisayinele le ncwadanaingezantsi.

03 March 2011

Mna ..... njengomzalika.....
ndiyavumaokanyeandivumiukubaathatheinxaxhebakoluphando. Enkosi.

Signature..... Date: .....

APPENDIX D

INTERVIEW 1 WITH GRADE 4-6 TEACHER (Miss G.)

NTABA MARIA PRIMARY SCHOOL

FEBRUARY 2011 (14HOO-14H30)

Z	OK, *enkosi Miss G ngexeshalakho*. (thank you for your time) As I have promised this will not take much of your time, thank you!
G	No problem Zuki.
Z	Can you tell me a bit more about your qualifications in teaching profession?
G	I have Higher Diploma in Education; I did my SP diploma at Algoa College of Education and proceeded to University of PE.
Z	Ok, you have been teaching for almost 13 years, what do you feel about teaching science and mathematics? What I mean is…
Z	As a Natural Sciences teacher and teaching the basic classes, what do you think is the most challenging part when teaching science? for example, maybe asking question or introducing new topic etc.
G	I think when asking question questions, you expert learners to come up with good answers or their answer will show an understanding. This means their (learners view) will lead you as a teacher where to start your lesson. And I think their level of understanding is also important as they do not know how important their knowledge from home is.*Bayibona into abayenzeekhaya as something different kulentobayenzaeklasini.*
G	They also thinkscience*yintoengafikelelekiyo*forgetting that science is everywhere *ekhaya,* their everyday knowledge.
Z	Ok, Miss Gama, I get your point, but how do you make sure they understand you can teaching as sometimes you can teach but no leaners takes place now do you make sure that does not happen in you classes?
G	Sometimes you teach thinking that *baya–understander*(learners do understand) but when asking questions its' a different story.They have no idea or even teaching. So sometime it is better when teaching trying to ask learners to say what you are teaching in telling them in their own way of understanding and that is where you will see if they are understand you or not.
G	This will make you think of other strategies as a teacher. So as to make sure your

	learners understand better.
Z	Ok, now in that case how do you introduce topics/lesson in class(new topic)
G	As they are from the previous grade, I always ask them questions related to the new topic to see if they still remember what they've done from the previous grade, if I see that they have forgotten I have to start at the lower level as I cannot start with this new topic. This will help me as a teacher to build a good foundation for my learners

Z	So, from your response do you think the assumption based on the learners that they are suppose to know this or that already is working?
G	No, no, no, not at all, *ayisebenzi kwaphela,* because it will not help to move to a new knowledge/topic while your learners are totally clueless So, you are building on *ukunga* .
Z	Now, moving to the next question If you were to teach acids and bases how would you approach this topic?
G	Mhmh… I think *bekuzakufuneka sichaze kuqala ukubayintoni iAcid, yintonii Base*, and what are their characteristics *zazo,* and then it is important for learners to understand these big levels as they have no meaning to them at all.
G	For example, acids and bases are used at home but bona abantwana they don't know if is an acid or a base, so it is important to introduce this topic using daily examples first before you move to other examples (unfamiliar).
Z	So do you think acids and bases are important as part of teaching and learning in our syllabus?
G	Mh… I am not so sure about that but to know which substance is an acid and which is a bases?
Z	Now, as a person who did science up a higher level don't you think acids and bases are introducing learners to chemistry?
G	Yes there are especially when using daily examples learners will be interested in science and it will make them see that although we are using these big words, science is about things that we used from our homes.[They will be encouraged to have more knowledge].
Z	Ok, now in your lesson do you ever use everyday knowledge of learners when teaching.
G	Yes, I do for instance when teaching lightning I ask them first about things they do at home when there is thunder and lightning? -Dangers of lightning-

	Do's and Don'ts Some of them will say- we cover mirrors, we do not eat or whatever, And then *ezinye zezinto zizinto nje, but umntwana ebeyazi what to do ngela xesha.*
Z	So, would you think that *izinto ezinjenge* lightning are based on cultural views? Based on everyday knowledge?
G	Yes, Some of the facts that come up with learners are bases or cultural views, because even if as a teacher you would like to account on such facts you might not understand them well as they are based on cultural views
Z	So, now how do you differentiate how facts between cultural views and scientific facts?[*Umsusa njani umntwana kulo nkolelo*].
G	It is very difficult to do so, but when it comes to science facts, you can prove to them and learners can observe these facts. While with cultural beliefs they grew up with these things – and they are from their parents – told stories- why? Why is it different? Because Lento *ibizakwenzeka ekhaya isenokwenzeka nakwi* furniture shops… Such examples learners are still hesitant to believe such facts- (influenced by parent)

Z	How do you accommodate your learners, make them comfortable, and let them discuss in a free manner?
G	Sometimes it is difficult to accommodate all learners as some of them do not have the ability to speak in front of the whole class, but as a teacher you select the kind of a question that will make that learner feel comfortable to answer.
Z	So, I can safely say you do not let your learners discuss in your lesson, but after those discussions what do you do with their facts/discussions?
G	I listen to each group and then they report to each other so that they can clear some pints/facts for other learners. Each group will see where they went wrong – correct each other through reflections
	"I can safely say that"
Z	You agree that everyday knowledge can improve learners understanding of science/ some impact! You think that there is some relationship between everyday knowledge *yabantwana* and science knowledge

Z	As a science teacher, what do you think we should do or where to improve when teaching science in our classes? If you observe or looking around most learners do not consider science as a double subject? Where do you think we are lacking?
G	No 1: We must make sure we are in the level of learners when teaching – interest – culture learner's interest No 2: How we introduce new concepts it is very important, e. g practical task to motivate learners No:3 Relate – everyday knowledge, e.g paint mixtures at home. [you observe you understand]!
Z	THANK YOU!

INTERVIEW 2 WITH THE GRADE 7 TEACHER: Mr. M

FEBRUARY 2011 (13H00-13H30)

Z	Good Afternoon (T), How are you?
T	I am fine Zuki and you?
Z	I am fine, thanks.
Z	For how many years have you been teaching Natural Sciences?
T	I have been teaching Natural Sciences for, It's my 20th year now, for the past 20 yrs, you know I've been teaching the subject!
Z	Ok! My 2nd question (T) is ah… for how many years have you been teaching grade 7, as you are teaching Natural Sciences?
T	Yes this is my third year. You know grade7 is still primary, so I have been teaching at high school.
Z	Ok, so you have been teaching at a high school level, so can I assume that you have been teaching grade (10-12)
T	Grade 10-12, yes from grade 8-12.
Z	Grade 8-12
T	Ok, mh, with the Natural Sciences we have four strands: energy and change, matter and material, earth and beyond and Life and Living.
T	Earth and beyond, yes!
Z	Which one of these do you think you enjoy teaching?
T	Ah… I enjoy all four strands but if I can grade them, matter and material is my favorite, cause I enjoy teaching chemistry
Z	Ok, so you enjoy teaching chemistry
T	Yes, I enjoy it.
Z	And, now if you enjoy teaching chemistry, now when teaching Natural Sciences and teaching the lower grades, reflecting you self don't you teaching you are teaching one strand (matter and material) more than others.
T	It depends with the curriculum what are the requirements of the curriculum Mh… so if you consider the curriculum is quite balanced, you know in the curriculum there is no strand more than the other,
Z	When teaching NS what do you hope to achieve with your learners?

T	You know when I'm teaching NS Zuki my intentions is that when my learners are living my class, they are suppose to integrate, what they've learnt in the classroom, they are suppose to apply it, you know in their everyday life, when they encounter problems they are suppose to go back in the classroom you know, in order to solve those challenges in life, that means apply it and use it in life.
Z	OK, Thank you!
Z	A*mh*…To your understanding is everyday/knowledge of learners important when teaching Natural Sciences.
T	Ok, everyday knowledge is important because really learners experience is vital to their understanding of the subject matter, so when I teach NS, I take everyday knowledge of learners as a starting point, in my teaching.
Z	Ok, (T) I hear you, can you elaborate this for me?
T	Yes, you know when you are teaching Science there is a need to link it to experiences of learners, what they know and then from there now, you can get to the feel to complex in that way learners are able to appreciate science as a subject, cause really science is part of life, we live with it everything is Science, so what we experience is science, so that is important.
Z	Ok,(T) now that you said that I'm interested to know, now do you approach the teaching of Acid and bases in your class? What are your strategies?
T	Ok, learners there are so many materials which are made from acids and bases which learners they interact with in their everyday life, things like soap, margarine etc. Pains industries-fertilizers chemical industries cosmetics etc (acid and bases)
Z	Ok, (T)
Z	Knowing that some children are coming from different backgrounds you'll find that some children do not know anything about explosive all those things, how do you balance your teaching?
T	Yes, we have some substances like mineral drinks, coke, fanta - learners they know about those things so I used common things which they know and we start from there.
Z	*Ehm*…, how do you connect this topic to everyday life? (Acid and base)
T	From what they know the actual content, what are acids/bases; importance of acids and bases for example fruit- taste/ touching it, they are Learning from that.
Z	Ok (T), what learning and support material do you use in the topic? I think you've also tried to answer this question?

T	I usually ask learners to bring these substances/ materials to the classroom and then we get into the list of the topic.(everyday material)

Z	Ok, How many lessons constitute your topic of acid and bases?
T	2 lessons for acids and then the other two for bases(4 lessons)
Z	Ok, do you actually stick to those four lessons, how do you accommodate those slow learners?
T	Mhmm…what I usually do first is introduction- ask learners to bring acidic and secondly I get to the lesson what it is, what are properties of acids then I conclude, same as bases.
Z	Now (T) if I may ask, remember you said you ask learners to bring acidic substances, maybe the learner doesn't even know the word acid- although using these at home?
T	That's the time I use bitter and sour you know, normally I don't know but they are used to these terms and then I explain.
Z	Now (T) If I may ask what challenges are you faced with in teaching this topic?
T	(Mh..ah..) when I'm teaching acids and bases the challenge I face is the from my learners to appreciate the importance
	Of acids and bases, if you take for examples acids, most materials are made from acids, so real it is the challenge for learners to understand that this lesson is part of them? We cannot live without Acid and bases The things they use at home.
Z	Ok! so do you have anything that you can elaborate or ray about teaching acids and bases in grade 7 or generally
Z	Ok, considering their level!
Z	(T) thanks a lot for your time I think we've done our best
T	Ok, Zuki. Thanks a lot too this is the first time I've been taped and hear my voice.

APPENDIX E

Questionnaire for learners' profile 2011

Schools: Ntaba Maria primary

Instructions:

- Please read each question carefully and follow instructions given on some of the questions.
- Circle the correct code for choice questions and write in the space provided for short answer questions

Section A: Profile of learners			
No.	**Question**	**Response**	**Code**
1.	Age	11-12 13-14 15-16 17+	1 2 3 4
2.	Gender	Male Female	1 2
3.	Grade	7	1
3.	Grade repeated	1 2 3 4 5 6 7	1 2 3 4 5 6 7

4	Who do you stay with at home? (*You can circle more than one*)	Mother Father Both parents Grandmother Uncle/Aunt Without parents: Siblings only Other, specify:	1 2 3 4 5 6 7
5	How do you get to school? (*If you walk, please answer question 6*)	Walk Cycle Public Transport Other, specify	1 2 3 4
6	How far do you walk to school? (*In Kilometres*)	0-1 2-3 4-5 6+	1 2 3 4
7	Where is your home?	Tantyi Joza Ext. 6,7,8,9 Town Coloured area Fingo Hlalani, Vukani	1 2 3 4 5 6 7

Section B: Profile of parents/guardians			
8	Are your parents/guardians:	Employed Self employed Unemployed Retired/pensioners	1 2 3 4
9	If they are employed, what do they do?		
10	What are the levels of education of the following people: (E*xample: Mother- Grade 10*)	Mother: Father: Grandparents:	
11	What is the highest level of education reached in your family? (*Example grade 12, Degree/Diploma etc*)		
Section C: Aspirations			
12	What would you like to become one day?		
13	How can your school help you reach your goals?		
14	What are your favourite subjects/learning areas?		

15	Where do you see yourself in 5 years?	In school At University/college Employed Married Other, specify.....	1 2 3 4 5
16	Would you like to go to university?	Yes No	1 2
17	If **yes**, which university would you like to go to?		
18	If **no**, what would you like to do?		
19	Who is your role model?	Mother/Father Teacher Brother/Sister Celebrity Aunt/Uncle Other, specify.....	1 2 3 4 5 6
20	What do you admire most about this person?		
21	Do you see yourself coming back to Grahamstown after your studies?	Yes No	1 2
22	If **yes,** what contribution would you bring to the community?		

23	If **no**, please explain why you wouldn't come back to this community		

Section D: Academic

24 How do you rate your performance in **EACH** of the following subjects?

(*Please tick one for each subject, feel free to add other subjects that we might have left out*)

Subject	**Very Good**	**Good**	**Satisfactory**	**Fair**	**Poor**
Mathematics					
English					
Natural Sciences					
Social sciences					
IsiXhosa					
Life Orientation					
Arts and Culture					
Technology					
EMS					

25	What would help you improve your grades/marks?		
26	What career guidance do you receive at school?		
27	Do you use the library?	Yes No	1 2

28	If **yes**, how often do you use the library?	Always Often Sometimes Seldom Never	1 2 3 4 5
29	If you do **NOT** use the library, please state why?		
30	Do you do practical work/ practical activities at your school/experiments?		
31	If **yes,** how do you find them?		
32	If **no,** why?		
Section E: Extra-curriculum activities			
33	What is/are the chore/s you perform ***before*** school every day? *(You can circle more than one)*	Cleaning the house Washing Dishes Fetching water Nothing	1 2 3 4
34	What is/ are the chore(s) you perform ***after*** school every day? (*You can circle more than one*)	Cooking Fetching water Washing dishes Herding cattle, goats, sheep or donkeys Cleaning the house Nothing Other, specify	1 2 3 4 5 6 7

35	What is your **favourite** extra-curriculum activity? And why?		
36	What benefit do you see from this extra-curricular activity for now and for the future?		
Section F: Extra-mural activities			
37	What extracurricular activity (ies) are you involved in at school?	Music Sport Reading club Drama Nothing Other, specify	1 2 3 4 5 6
38	What extracurricular activity (ies) are you involved in, in the community?		
40	If **Yes**, what do you think of the programme?		
39	If **No**, would you like to be involved?	Yes No	1 2
40	Are you involved in the Khanya Science and Maths club?	Yes No	1 2
41	If **yes**, what do you think of the club?		
42	If **no**, would you like to be involved in the club? And why?		

ELICITATION OF PRIOR KNOWLEDGE:

Questionnaire 2: (section A)

Do you have *or*do you use the following substances at home?

Substances that I use at home.	**Explain in what way, e.g. to clean, to reduce bad smells, to drink and eat etc.**	**How does it feel like or taste like?**
Dish washing liquid/soap		
Handy- Andy		
Sunlight soap/(bar soap)		
powder soap		
Bleach		
Window cleaner		
Ammonia		
Bicarbonate of soda		
Cream of tartar		
Vinegar		
Lemon juice (lemons)		
Domestos		
grapes		
milk		
Fizzy drinks e.g. Coca-cola		
Tooth paste		
OTHER THINGS THAT YOU USE AT HOME (not mentioned above)		

SECTION B:

OPEN- ENDED QUESTIONS:

1. What do people use when they have a heart burn and why?

2. What do people use for reducing the smell under arms, especially if they do not have a roll-on and why?

3. What is ENO used for?

4. In your understanding is there a similarity (things that are the same) in "umqombothi" and "amarhewu"? If so explain these similarities.

5. In knowledge/understanding are wood ashes useful to people if so how?

(L29)

Questionnaire for learners' profile 2011

Schools: Case 1- Ntaba Maria primary

Case 2- Seventh day Adventist primary

Instructions:

- Please read each question carefully and follow instructions given on some of the questions.
- Circle the correct code for choice questions and write in the space provided for short answer questions

Section A: Profile of learners			
No.	Question	Response	Code
1.	Age	11-12	1
		13-14	(2)
		15-16	3
		17+	4
2.	Gender	Male	1
		Female	(2)
3.	Grade	7	(1)
3.	Grade repeated	1	1
		2	2
		3	3
		4	4
		5	5
		6	6
		7	7
4	Who do you stay with at home?	Mother	(1)
	(You can circle more than one)	Father	2

		Both parents	3
		Grandmother	(4)
		Uncle/Aunt	(5)
		Without parents: Siblings only	6
		Other, specify:	7
5	How do you get to school? (*If you walk, please answerquestion 6*)	Walk	1
		Cycle	2
		Public Transport	(3)
		Other, specify	4
6	How far do you walk to school? (*in Kilometres*)	0-1	1
		2-3	2
		4-5	3
		6+	4
7	Where is your home?	Tantyi	1
		Joza	2
		Ext. 6,7,8,9	(3)
		Town	4
		Coloured area	5
		Tingo	6
		Hlalani, Vukani	7
Section B: Profile of parents/guardians			
8	Are your parents/guardians:	Employed	(1)
		Self employed	2
		Unemployed	3
		Retired/pensioners	4
9	If they are employed, what do they do?	they cook, others are plumbers	

10	What are the levels of education of the following people: (Example: Mother- Grade 10)	Mother: grade 12 Father: grade 12 Grandparents: grade 12	
11	What is the highest level of education reached in your family? (Example grade 12, Degree/Diploma etc)	degree	
	Section C: Aspirations		
12	What would you like to become one day?	I would like to be a Geographer (physicologist)	
13	How can your school help you reach your goals?	by helping & educate me more & more so that, can get more knowledge	
14	What are your favourite subjects/learning areas?	English	
15	Where do you see yourself in 5 years?	In school At University/college Employed Married Other, specify.....	1 (2) 3 4 5
16	Would you like to go to university?	Yes No	(1) 2
17	If yes, which university would you like to go to?	Fort hare, Fortknox	
18	If no, what would you like to do?		

19	Who is your role model?	Mother/Father	1
		Teacher	2
		Brother/Sister	3
		Celebrity	4
		Aunt/Uncle	(5)
		Other, specify.....	6
20	What do you admire most about this person?	I admire his knowledge & he's so talented & he's also achieved his goals	
21	Do you see yourself coming back to Grahamstown after your studies?	Yes	1
		No	(2)
22	If yes, what contribution would you bring to the community?		
23	If no, please explain why you wouldn't come back to this community	Because I want to go & see how I can work with People who are different	

Section D: Academic

24 How do you rate your performance in EACH of the following subjects?

(Please tick one for each subject, feel free to add other subjects that we might have left out)

Subject	Very Good	Good	Satisfactory	Fair	Poor
Mathematics				✓	
English		✓			
Natural Sciences			✓		
Social sciences			✓		
IsiXhosa		✓			
Life Orientation		✓			

	Arts and Culture		✓				
	Technology			✓			
	EMS			✓			

25	What would help you improve your grades/marks?	by studying & focusing & trying my best	
26	What career guidance do you receive at school?	not yet	
27	Do you use the library?	Yes No	(1) 2
28	If yes, how often do you use the library?	Always Often Sometimes Seldom Never	1 2 (3) 4 5
29	If you do **NOT** use the library, please state why?		
30	Do you do practical work/ practical activities at your school/experiments?	yes	
31	If yes, how do you find them?	I find, them very intresting.	
32	If no, why?		

Section E: Extra-curriculum activities

33	What is/are the chore/s you perform *before* school every day? *(You can circle more than one)*	Cleaning the house Washing Dishes	(1) (2)

		Fetching water	3
		Nothing	4
34	What is/ are the chore(s) you perform *after* school every day? *(You can circle more than one)*	Cooking	(1)
		Fetching water	2
		Washing dishes	(3)
		Herding cattle, goats, sheep or donkeys	4
		Cleaning the house	(5)
		Nothing	6
		Other, specify	7
35	What is your **favourite** extra-curriculum activity? And why?	Netball because netball is the sport that I really admire & Play very well.	
36	What benefit do you see from this extra-curricular activity for now and for the future?	they can help me go far because I have talents	
Section F: Extra-mural activities			
37	What extracurricular activity (ies) are you involved in at school?	Music	(1)
		Sport	(2)
		Reading club	3
		Drama	4
		Nothing	5
		Other, specify	6
38	What extracurricular activity (ies) are you involved in, in the community?	netball, jive	
40	If Yes, what do you think of the programme?	its fun	
39	If No, would you like to be involved?	Yes	(1)
		No	2

40	Are you involved in the Kisanyo Science and Maths club?	Yes No	1 (2)
41	If yes, what do you think of the club? yes	I think maybe it gives children (learners) more knowledge & know more.	
42	If no, would you like to be involved in the club? And why?		

Thank you!!!

Performance Standard 1 : CREATION OF A POSITIVE LEARNING ENVIRONMENT 2

CRITERIA : (a) Learning Space (b) Learner Involvement (c) Discipline (d) Diversity

	LEVELS OF PERFORMANCE	MARK	STRENGTHS	RECOMMENDATIONS	CONTEXTUAL FACTORS
1	UNACCEPTABLE				
(a)	No effort to create a learning space that is conducive to teaching and learning ; organization of learning space hampers teaching and learning.				
(b)	Educator and learners appear intimidated.				
(c)	No discipline and much time is wasted. Learners do not accept discipline or discipline is experienced by learners as humiliating.				
(d)	Educator is insensitive to racial, cultural and/or gender diversity; does not respect dignity of individual learners or groups of learners.				
2	SATISFIES MINIMUM EXPECTATIONS				
(a)	There is evidence of an attempt at creating and organising a suitable learning environment, which enables individual and/or group learning.				
(b)	Learners are engaged in appropriate activities for most of the lesson				
(c)	Learners are disciplined and learning is not interrupted unnecessarily				
(d)	Learning environment is free of obvious discrimination				
3	GOOD				
(a)	Organisation of learning space enables the effective use of teaching resources and encourages and supports individual and group activities.				
(b)	Stimulating environment. Learners participate actively.				
(c)	Learners are encouraged; there is positive reinforcement. Learners accept discipline without feeling threatened.				
(d)	Educator acknowledges and respects individuality and diversity.				
4	OUTSTANDING				
(a)	Organisation of learning space shows creativity and enables all learners to be productively engaged in individual and cooperative learning.				
(b)	Learners participate actively and are encouraged to exchange ideas with confidence and to be creative.				
(c)	Learners are motivated and self-disciplined.				
(d)	Educator uses inclusive strategies and promotes respect				

APPENDIX F

Performance Standard 2 : KNOWLEDGE OF CURRICULUM AND LEARNING PROGRAMMES 3

CRITERIA : (a) Knowledge of Learning Area (b) Skills (c) Goal setting (d) Involvement in learning programmes

	LEVELS OF PERFORMANCE	MARK	STRENGTHS	RECOMMENDATIONS	CONTEXTUAL FACTORS
1	UNACCEPTABLE				
(a)	Educator conveys inaccurate and limited knowledge of learning area.				
(b)	No skill in creating enjoyable learning experience for learners.				
(c)	Little or no evidence of goal-setting to achieve curriculum outcomes.				
(d)	Makes no attempt to interpret the learning programmes for the benefit of learners.				
2	SATISFIES MINIMUM EXPECTATIONS				
(a)	Educator's knowledge is adequate but not comprehensive.				
(b)	Has some skill in engaging learners and relating the learning programme to learner's needs.				
(c)	Evidence of some goal setting to achieve curriculum outcomes.				
(d)	Makes some attempt to interpret the learning programmes for the benefit of learners.				
3	GOOD				
(a)	Educator is able to use knowledge and information to extend the knowledge of learners.				
(b)	Educator skilfully involves learners in learning areas.				
(c)	Makes every endeavour to set realistic goals to achieve curriculum outcomes.				
(d)	Displays great enthusiasm in interpreting learning programmes in the interests of the learners.				
4	OUTSTANDING				
(a)	Educator uses knowledge to diagnose learner strengths and weaknesses in order to develop teaching strategies.				
(b)	Educator uses learner-centered techniques that provide for acquisition of basic skills and knowledge and promotes critical thinking and problem solving.				
(c)	Curriculum outcomes are always achieved by being creative and innovative in the setting of goals.				
(d)	Excellent balance between clarity of goals of learning programme and orientation of learner needs, interests and background.				

Performance Standard 3 : LESSON PLANNING PREPARATION AND PRESENTATION 4

CRITERIA : (a) Planning (b) Preparation (c) Recording (d) Management of Learning Programmes.

	LEVELS OF PERFORMANCE	MARK	STRENGTHS	RECOMMENDATIONS	CONTEXTUAL FACTORS
1	UNACCEPTABLE				
(a)	Little or no evidence of lesson planning				
(b)	Lessons not presented clearly				
(c)	No records kept				
(d)	Learners not involved in lesson in a way that supports their needs and the development of their skills and knowledge				
2	SATISFIES MINIMUM EXPECTATIONS				
(a)	Lesson planning not fully on a professional standard				
(b)	Lessons are structured and relatively clearly presented				
(c)	Evidence of essential records of planning and learner progress is available				
(d)	Evidence of some learner involvement in lessons in a way that it supports their needs and the development of their skills and knowledge				
3	GOOD				
(a)	Lesson planning is generally clear, logical and sequential				
(b)	Lessons are well structured and fit into broader learning programme building on previous lessons and anticipating future learning activities				
(c)	Essential records of planning and learning progress are maintained at a high level of proficiency				
(d)	Good involvement of learners in lessons in such a way that it supports their needs and the development of their skills and knowledge				
4	OUTSTANDING				
(a)	Lesson planning is abundantly clear, logical, sequential and developmental				
(b)	Outstanding planning of lessons that are exceptionally well structured and clearly fits into the broader learning programme with evidence that it builds on previous lesson as well as fully anticipating future learning activities				
(c)	Outstanding record keeping of planning and learner progress				
(d)	Excellent involvement of learners in lessons in such a way that it fully support their needs and the development of their skills and knowledge				

Performance Standard 4 : LEARNER ASSESSMENT/ACHIEVEMENT 5

CRITERIA : (a) Feedback to learners (b) Knowledge of assessment techniques (c) Application of techniques (d) Record keeping

	LEVELS OF PERFORMANCE	MARK	STRENGTHS	RECOMMENDATIONS	CONTEXTUAL FACTORS
1	UNACCEPTABLE				
(a)	No evidence of meaningful feedback to learners, or feedback irregular and inconsistent				
(b)	Does not demonstrate an understanding of different types of assessment, eg. Only uses tests				
(c)	Assessment results do not influence teaching strategies				
(d)	No evidence of records, or records are incomplete and irregular				
2	SATISFIES MINIMUM EXPECTATIONS				
(a)	Some evidence of feedback				
(b)	Has a basic understanding of different types of assessment				
(c)	Some evidence of corrective measures and remedial activity based on assessment results				
(d)	Maintains essential records				
3	GOOD				
(a)	Feedback is regular, consistent and timeously provided				
(b)	A variety of assessment techniques are used, allowing learners to differentiate their talents				
(c)	Lessons are appropriately tailored to address learners' strengths and areas of weakness				
(d)	Records are systematically, efficiently and regularly maintained				
4	OUTSTANDING				
(a)	Feedback is insightful, regular, consistent, timeous and built into lesson design				
(b)	Different assessment techniques used to cater for learner from diverse backgrounds, with multiple intelligence and learning styles				
(c)	Assessment informs multiple intervention strategies to address specific needs of all learners and motivates them				
(d)	Records are easily accessed and provide insights into individual learners' progress				

APPENDIX G

Grade: 7 Lesson		**Learning Area: Natural Sciences**
Strand: Matter and Material		
Duration: 1week (5 day lesson plan)		**Content in Context: Acids and Bases**
<u>Integration:</u> **Language:** LO 2: Speaking LO 3: Reading **Mathematics:** LO 5: Data Handling AS: Design simple Questionnaires **Technology:** LO 1: Technological processes and skills		
Selected LOs and Assessment Standards	**Teaching and Learning Activities**	**Details of assessment**
LO 1: SCIENTIFIC INVESTIGATIONS **AS:** Plans investigations: **AS:** Conducts investigations **AS:** Evaluates data and communicates findings	**Discovering properties of acids and bases** **Day 1:** **Teacher:**After dividing the learners into groups, the teacher will give instructions to the whole class about what each group should do.	• Learners will discuss about the question at hand: (What are the uses of the substances given to each group- this will be according to the learners' knowledge and previous experiences from home). All these will be detailed when reporting back to the class. • Questions will be asked as learners

LO2: CONSTRUCTING SCIENCE KNOWLEDGE: **AS:** Recalls meaningful information: **AS:** Interprets information: **L O 3: SCIENCE, SOCIETY AND THE ENVIRONMENT** **AS:** Understands science and technology in the context of history and indigenous knowledge. **LO 1: SCIENTIFIC INVESTIGATIONS** **AS:** Plans investigations: **AS:** Conducts investigations **AS:** Evaluates data and communicates findings **LO2: CONSTRUCTING SCIENCE KNOWLEDGE:** **AS:** Recalls meaningful information:	Each group will be given six substances to discuss about and have to report back to the class about its findings. **Learners** will be randomly divided into groups of five members in each group. Learners will discuss about how they use substances like (vinegar, lemon juice, coca-cola, handy- andy, bleach and soap) at home. All these uses will be written down on a chart so as for each group to report back in class. During presentations: examples like the following are expected or assumed to come up. • Dish washing liquid removes dirt and grease from dishes • Soap is used to wash our bodies and remove bed smells • Vinegar is used in salads etc, • Bleach is used to remove stains. **Teacher:** The teacher will try to probe learners by asking questions so that they can	present their findings. Learners will be asked to summarise the data that came up from the presentations. **ASSESSMENT:** After these discussions and presentations learners will be asked to group/classify these substances using the data they have. **ASSESSMENT:** Learners will conduct a small investigation using the everyday substances that are used in most homes. Learners will have to taste and feel the substances in front of them. Each learner will have a chance to do so and the group will read their findings to the class.

AS: Interprets information: **L O 3: SCIENCE, SOCIETY AND THE ENVIRONMENT** **AS:** Understands science and technology in the context of history and indigenous knowledge.	come up with more art effects in their discussions and presentations. **Day 2:** **Learners:** From the above activity each group will get a labelled test tube rack with all the substances that were discussed in activity 1. Now all learners in each group will follow the instructions read by the teacher in front of them. This means that each group will get a paper with instructions and the work to be done by each group.	Again after these findings the groups will go back to their classifications from the first activity so as verify their answers. Furthermore the groups have to write everything they know so far about each group using their classification.
LO 1: SCIENTIFIC INVESTIGATIONS **AS:** Plans investigations: **AS:** Conducts investigations **AS:** Evaluates data and communicates findings **LO2: CONSTRUCTING SCIENCE**	**Day 3:** **Neutralization** **Learners and the teacher** In this activity learners were given different substances like floor cleaner, vinegar, bicarbonate of soda, tartaric acid and coke. Learners are going to be instructed to mix these substances using the guiding instructions	Learners are going to record the observations of these experiment (investigations). This will be an explanation to why people use bases to minimise acid in their stomach, and the same time an answer to some of the things that came up during discussions in the above activities.

KNOWLEDGE: **AS:** Recalls meaningful information: **AS:** Interprets information: **L O 3: SCIENCE, SOCIETY AND THE ENVIRONMENT** **AS:** Understands science and technology in the context of history and indigenous knowledge.	in front of them. In this way learners will be doing neutralization of acids without knowing. **Day 4:** At this stage the **teacher** will take learners through from the beginning of the lesson trying to explain why some of the substances behave the way they do (substances that were brought in class by both teachers and learners). Examples from the discussions will be used and the words ACID OR BASE will come up while the teacher explains to learners. Notes will be written during this activity. **Indicators** The teacher will demonstrate to learners an experiment where learners will also have their apparatus to do the same experiment. The teachers will give each group an acid or a base (different ones) so as to investigate what will happen when they add few drops of each	After this activity learners will now in pairs writing the properties of acids and bases from the teachers' explanation and from the above discussions (learners' discussions). Learners will be given a task to see if they understood the meaning and the purpose of indicators.

	substance to a black tea. The teacher will explain further by telling learners more about the use of indicators. **Day 5**: Test	FORMAL ASSESSMENT (Test) Learners will be given a task on acids and bases to see if they understood the concepts, and gained knowledge of acids and bases.

ACTIVITY 1:

IN YOUR UNDERSTANDING, WHAT DO WE USE THE FOLLOWING FOR AND HOW DO WE USE THEM?

Tartaric Acid		
Dish washing liquid/soap		
Handy- Andy		
Sunlight soap/(bar soap)		
powder soap solution		
Bleach		
Window cleaner		
Bicarbonate of soda		
Vinegar		
Domestos		
grapes		
milk		
Coca-cola		
Tooth paste		

ACTIVITY 2:

IN YOUR GROUPS, YOU SHOULD SELECT SOMEONE WHO IS GOING TO BE YOUR WRITER. EACH PERSON IN YOUR GROUP MUST EITHER TASTE OF FEEL EACH SUBSTANCE AND REPORT TO THE GROUP. IF NOT SURE THEN SOMEONE ELSE CAN RE-DO THE PROCESS.

Name of a substance	***How does it taste?***	***How does it feel?***
Tartaric Acid		
Dish washing liquid/soap		
Handy- Andy		
Sunlight soap/(bar soap)		
powder soap solution		
Bleach		
Window cleaner		
Bicarbonate of soda		
Vinegar		
Domestos		
grapes		
milk		
Coca-cola		
Tooth paste		

ACTIVITY 3:

OBSERVATIONS

1) What do you observe when you mix bicarbonate of soda with vinegar?

_____

_____

_____

2) What do you observe when you mix a floor cleaner is mixed with vinegar?

_____

_____

_____

3) What do you observe when a tartaric acid is mixed with bicarbonate of soda?

_____

_____

_____

4) What do you observe when coca-cola is mixed with domestos?

_____

_____

_____

ACTIVITY 4: IN PAIRS

1. NOTE: Use your discussions, notes and the explanation from the teacher to write the properties of the following groups:

ACIDS	BASES

2. Again, from what we have done in class, now group the following under these two groups: *Vinegar, Lemon juice, Colgate, Handy- Andy, Domestos, Coca-cola, Tartaric acid and a floor cleaner.*

ACIDS	BASES

ACTIVITY 5: (Practical activity)
As you have observed, when few drops of vinegar are added in a black tea the tea becomes *lighter* (change of colour) but when few drops of *handy- andy*are added in a black tea the tea becomes *darker.* Now you understand that vinegar is an acid and handy- andy is a base.
Question: What do you think will happen if you add few drops of the following substances in your red cabbage indicator and why?

Name of Substances	**Black tea**
1. Lemon juice	
2. Domestos	
3. Apple juice	
4. Grape juice	
5. Floor Cleaner	

Name of Substances	**Red cabbage indicator**
1. Lemon juice	
2. Domestos	
3. Apple juice	
4. Grape juice	
5. Floor Cleaner	

NATURAL SCIENCES ASSESSMENT:

STRAND: MATTER AND MATERIAL

CONTENT IN CONTEXT: ACIDS AND BASES

INSTRUCTIONS: READ THE QUESTION BEFORE YOU ANSWER.

TO ANNSWER THE QUESTIONS USE AN EXTRA PAER PROVIDED

Total mark (35)

A. Fill in the missing word:

1. **Acids have a _____ taste. (1)**
2. **Bases have a _____ taste. (1)**
3. **Bases feel _____ and acids feel _____ . (2)**
4. **An _____ tells us if a substance is a base or an acid. (1)**

B. Group the following substances into acids and bases. Lemon juice, Handy –Andy, Bar-soaps, Coca-cola, Domestos and Tartaric acid. (6)

Acids: **Bases:**

C. Explain the following words: (10)

1. **A base**

_____

_____

2. **An acid**

_____

_____

3. **Neutralization**

_____

_____

4. **An indicator**

_____

_____

5. **Properties**

_____

_____

D. GIVING EXAMPLES: (14)

1. **Give 3 examples of acids that can be found at home:**

_____

_____

2. **Give 3 examples of bases that can be found at home:**

_____

_____

3. **Give two types of indicators that can be found at home. (2)**

_____

_____

4. **What do we call the process of mixing a base and an acid?**

(2)_____

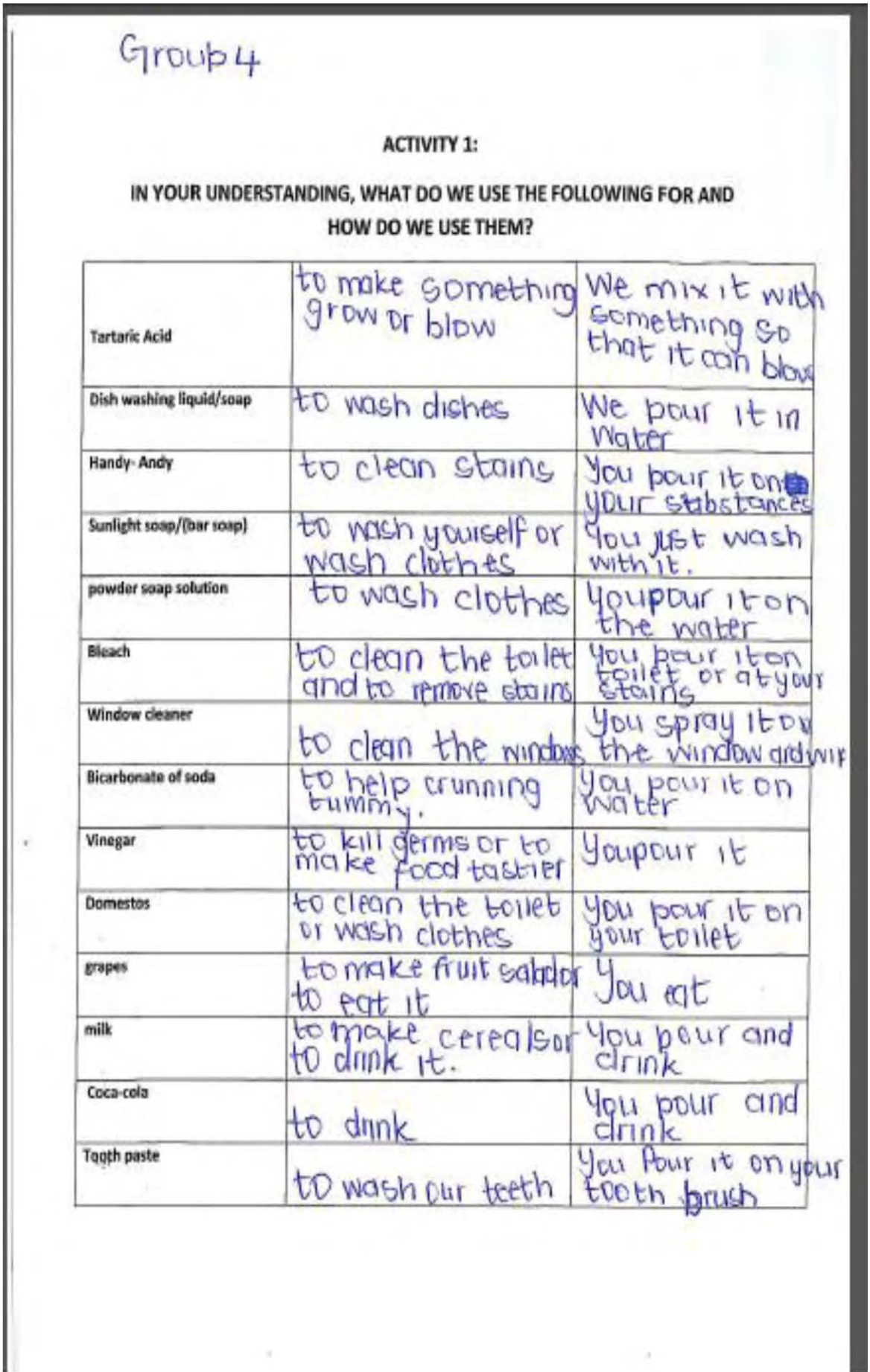
_____

5. **Which one is the strongest a liquid from a car battery or a coca- cola cool drink?**

(1)_____

_____

APPENDIX H



Group 4

ACTIVITY 1:

IN YOUR UNDERSTANDING, WHAT DO WE USE THE FOLLOWING FOR AND HOW DO WE USE THEM?

Tartaric Acid	to make something grow or blow	We mix it with something so that it can blow
Dish washing liquid/soap	to wash dishes	We pour it in water
Handy- Andy	to clean stains	You pour it on your substances
Sunlight soap/(bar soap)	to wash yourself or wash clothes	You just wash with it.
powder soap solution	to wash clothes	Youpour it on the water
Bleach	to clean the toilet and to remove stains	You pour it on toilet or at your stains
Window cleaner	to clean the windows	You spray it on the window and wip
Bicarbonate of soda	to help crunning tummy.	You pour it on water
Vinegar	to kill germs or to make food tastier	Youpour it
Domestos	to clean the toilet or wash clothes	you pour it on your toilet
grapes	to make fruit salad or to eat it	You eat
milk	to make cereal or to drink it.	You pour and drink
Coca-cola	to drink	You pour and drink
Tooth paste	to wash our teeth	You pour it on your tooth brush

Group 5

ACTIVITY 1:

IN YOUR UNDERSTANDING, WHAT DO WE USE THE FOLLOWING FOR AND HOW DO WE USE THEM?

	WHAT DO WE USE THEM FOR?	HOW DO WE USE THEM?
Tartaric Acid		
Dish washing liquid/soap	We use it when we wash dishes	We first boil water. then pour the water in a bowl and pour dish was
Handy- Andy	We use it when we want to get rid of stains	We just take a cloth and pour handy-andy and clean the stoves.
Sunlight soap/(bar soap)	We use it into different ways eg. washing dishes, cloths.	We rub it against cloths with water.
powder soap solution	We use it for washing clothes & dishes	We just pour it into the water & wash clothe
Bleach	We use it for washing clothes that have stains	We pour it into water & wash or soake
Window cleaner	We use it to wash or clean windows.	We just spray it against or on the window.
Bicarbonate of soda	We use it for baking.	We mixed it with flour etc and bake.
Vinegar	We use it to make food tasty.	We pour it in many diffrent food e.g fish & chips.
Domestos	We use it to clean germs (e.g) in the toilets	We pour or spray around the toilet & flush.
grapes	We use it for drinking and making juice, fruit salad.	Sometimes ~~the~~ we cut the grapes & just eat.
milk	We use it for drinking.	By pouring it into a glass & drinking
Coca-cola	We use it for drinking	We just pour it into a glass & drink
Tooth paste	We use it for bad smells and cleaning our teeth.	We pour it into a tooth paste brush and brush our teeth.

Group 8

ACTIVITY 2:

IN YOUR GROUPS, YOU SHOULD SELECT SOMEONE WHO IS GOING TO BE YOUR WRITER. EACH PERSON IN YOUR GROUP MUST EITHER TASTE OF FEEL EACH SUBSTANCE AND REPORT TO THE GROUP. IF NOT SURE THEN SOMEONE ELSE CAN RE-DO THE PROCESS.

Put the red dot next to the ones you do not have in front of you.

Name of a substance	*How does it taste?*	*How does it feel?*
Tartaric Acid	Sour	Soft
Dish washing liquid/soap	Sour	Smooth
Handy- Andy	Sour	Smooth
Sunlight soap/(bar soap)	Bitter	Smooth
powder soap solution	Sour	Rough
Bleach	Sour	Smooth
Window cleaner	Sour	Smooth
Bicarbonate of soda	Bitter	Soft
Vinegar	Sour	Soft
Domestos	Bitter	Smooth
grapes	Sweet	Chrunchy
milk	little bit sweet	Smooth
Coca-cola	Sweet	Soft
Tooth paste	Chilly	Soft

Group 7

ACTIVITY 3:

OBSERVATIONS

1) **What do you observe when you mix bicarbonate of soda with vinegar?**

When you mix bicarbonatt of soda and vinegar it shows acid and bubbles

2) **What do you observe when you mix a floor cleaner is mixed with vinegar?**

When you mix floor cleaner with vinegar it change colour

3) **What do you observe when a tartaric acid is mixed with bicarbonate of soda?**

When you mix tartic acid and bicarbonate of soda it shows acid and bubbles

4) **What do you observe when coca-cola is mixed with domestos?**

When you mix coca-cola and domestos they all change colour

Group 8

ACTIVITY 3:

OBSERVATIONS

1) **What do you observe when you mix bicarbonate of soda with vinegar?**

There was acid that comes up and there we bubles inside it.

2) **What do you observe when you mix a floor cleaner is mixed with vinegar?**

There was bubles that goes up and down.

3) **What do you observe when a tartaric acid is mixed with bicarbonate of soda?**

There was lot of acid and bubles.

4) **What do you observe when coca-cola is mixed with domestos?**

It changed the colour to Yellow.

ACTIVITY 4: IN PAIRS

1. **NOTE: Use your discussions, notes and the explanation from the teacher to write the properties of the following groups:**

ACIDS	BASES
Vinegar - sour - rough watery	Bicarbonate of soda - bitter & rough
Coca-Cola - sweet - acidic	Dish washing liquid - bitter - slip
Tartaric acid - sour & rough	Handy-Andy - bitter, soft, slimy
	Bar soap - bitter - slippery & smoo
	Domestos - bitter, smooth & slimy

2. **Again, from what we have done in class, now group the following under these two groups: Vinegar, Lemon juice, Colgate, Handy- andy, Domestos, Coca-cola, Tartaric acid and a floor cleaner.**

ACIDS	BASES
Vinegar	Handy- Andy
Coca-cola	Floor-cleaner
Tartaric acid	Colgate
Lemon juice	

APPENDIX I

Natural Sciences: “ACIDS AND BASES”

FOCUS GROUP INTERVIEWS: GROUP 4 & 8

NOTE: As groups discuss how your understanding has developed in “acids and bases”, this means that you have to think and recall all what has been done in class based on acids and bases. These questions will help you for your interviews.

Answer the following questions:

1. List all acids and bases found and used at home.
2. What is the difference between acid and a base?
3. Can you name other acids and bases found at home that were not mentioned in class.
4. What did you think of the lesson on acids and bases?
5. Do you think it was in your level?
6. What was interesting about these lessons?
7. What do you think needs to be changed next time when doing this lesson?