An investigation of Grade 6 learners' conceptual understanding of task words and subject terminology in Natural Science and Technology formative assessments on the topic 'Electric circuits'.

A research report submitted to the faculty of Education (Maths and Science Division), University of the Witwatersrand, Johannesburg, in fulfilment for the degree of Masters in Science Education

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Declaration

I, **Brigette Soloman (1055296)** declare that this report is my own unaided work except where otherwise acknowledged. It is submitted for the degree of Masters in Science Education to the University of the Witwatersrand, Johannesburg, South Africa. It has not been submitted before for any degree or examination at any other University.

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Abstract

The purpose of this study was to gain insights into grade 6 learners conceptual understanding of the task words (used in Bloom's taxonomy) and key words (subject terminology) in the subject Natural Science and Technology (NST). This study was motivated by wanting to understand whether the possible cause of learners' poor performance in assessments was due to their lack of understanding of assessment questions. This was investigated through a case study conducted on 101 grade six learners at a South African primary school. Learners wrote a written test on the topic: electric circuits which was subsequently marked using a memo. Based on their scores obtained 14 learners were selected and grouped into 4 focus groups based on high, average, low scores, and a mixed group. The focus group discussions explore what were learners interpretations of the task words and subject terminology used in formative assessments. The transcripts were analysed both deductively and inductively. The data analysis revealed that grade 6 learners do not conceptually understand the task words and subject terminology used in NST formative assessments. The findings revealed that learners' interpretations depended on their understanding of either the task word or subject terminology, that the different meanings of words in colloquial English compared to academic language influenced their understanding of words, and that learners did not know how to approach assessment questions. The implication of this study is that NST teachers need to both tap into learner prior knowledge and collaborate with English teachers to assist learners understand assessment questions. The recommendation is that more time needs to be allocated for teaching task words and subject terminologies.

Acknowledgements

I would like to thank God for giving me the strength, ability, and opportunity to complete this report. I would like to thank my supervisors, Prof Kershree Padayachee and Dr Caleb Mandikonza for your continual support, encouragement, mentorship, and patience despite the challenges faced. Without you both, I would have not reached this stage and I am truly thankful for the impact you have made in my life. I would like to thank my learners and the parents who participated in this study. Lastly, I would like to thank my mom (Brenda) and my sister (Brittney) who motivated me and diligently supported me throughout this degree.

I would like to dedicate this project to my late dad, Soloman who lost his battle to cancer. This year will be 10 years without you, yet your constant impartation of wisdom that I can achieve anything still lingers. Thank you for always believing in me even when I did not believe in myself.

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CHAPTER 1

James Pierce once said, “The key to learning is an awareness of where you lack understanding.” (Lagace, 2022)

1.1 Introduction and Background

This study seeks to investigate grade six learners’ understanding of task words and key words used in Natural Science and Technology (NST) formative assessment tasks. The study was motivated by a case study I conducted in my Honours degree whereby I investigated the possible causes of grade four learners’ poor performance in Natural Science and Technology assessment tasks. That study identified possible causes of poor performance in NST, including difficult subject terminology and learners limited English proficiency which hindered their understanding of demands of tasks and consequent lack of effective communication of their answers. In addition, the Trends in International Mathematics and Science Study (TIMMS) conducts research on learners’ performance (Reddy, 2006). This involves providing grade 4 and grade 8 learners around the world with assessments based on knowledge on mathematics and science (Reddy et al., 2016). In 2003, “South Africa had the lowest performance scores in Mathematics and Science compared to the other TIMMS participants” (Reddy, 2006, p. xi). In 2015, “South Africa still scored as one of the lower performing countries in mathematics and science in comparison to other participating countries, however there was an improvement in their performance” (Reddy et al., 2016, p .15). Such findings disappointed me as a teacher. However, it also motivates me to analyse and better understand the teaching and learning that occurs in my class. I want my learners to improve their performance in NST and a keyway is to understand their performance in assessments.

Assessment is used to measure what knowledge a learner has attained which is further used to determine a learner’s performance in NST (Department of Basic Education, 2011). As stated in Curriculum Assessment Policy Statement (CAPS), “assessment is a continuous planned process of identifying, gathering, interpreting and diagnosing, information about the performance of learners” (Department of Basic Education, 2011, p. 65). Assessment can be formative assessment (informal) or summative assessment (formal) (Black & Wiliam, 2009). Formative assessment is assessment for learning whereby formative assessment provides guidance as to which direction teaching and learning is occurring in the class (Black & Wiliam, 2009; Department of Basic Education, 2011). Formative assessment also provides descriptive feedback to learners and focuses on helping the learner improve the knowledge they already

have (Black & Wiliam, 2009; Department of Basic Education, 2011). In NST, formative assessments are "done through observations, discussion, practical demonstrations, informal classroom interactions, classwork, investigations etc." (Department of Basic Education, 2011, p. 65). As teachers, we monitor a learner's progress that occurs daily in this way. Assessments are chosen to assess specific content within a topic (Department of Basic Education, 2011). Each topic has specific scientific subject terminology or key words that learners are required to understand to grasp the concept taught. Subject terminology is obtained from the textbooks used and concepts mentioned in CAPS document.

According to McComs (2013), "Academic Language in Science is the formal, precise terminology used in discipline-or domain-specific ways by those fluent or literate in that discipline" (McComas, 2013, p. 2). Therefore, in my understanding academic language in science equates to subject terminology as learners are required to read, write, speak, listen, and interact with specific language (words) in the discipline of NST (McComas, 2013). Subject terminology is vital in this study as subject terminologies have specific meanings which learners may have their own conceptions about. In NST, the concepts are developed cognitively from one grade to the next. Thus, learners need to have a correct understanding of the subject terminology they are interacting with as this may impact their performance in assessments and NST.

In addition, learners also need to understand task words from the revised Bloom's taxonomy, which can impact their ability to effectively engage with assessments. To achieve cognitive demands, assessments make use of task words focused on levels of cognition described by the revised Bloom's taxonomy (Paleeri, 2015). The revised Bloom's taxonomy is a framework designed to categorise ones thinking based on six cognitive levels with a gradual increase in complexity as seen in Figure 1 below (Forehand, 2011; McNulty, 2019). The revised Bloom's taxonomy assists teachers by providing them with specific task words that addresses a particular cognitive level that a learner should have developed (Paleeri, 2015). Using the revised Bloom's Taxonomy provides clarity of the question being asked and provides a solution to setting a well-balanced assessment which caters to different cognitive demands (Paleeri, 2015).

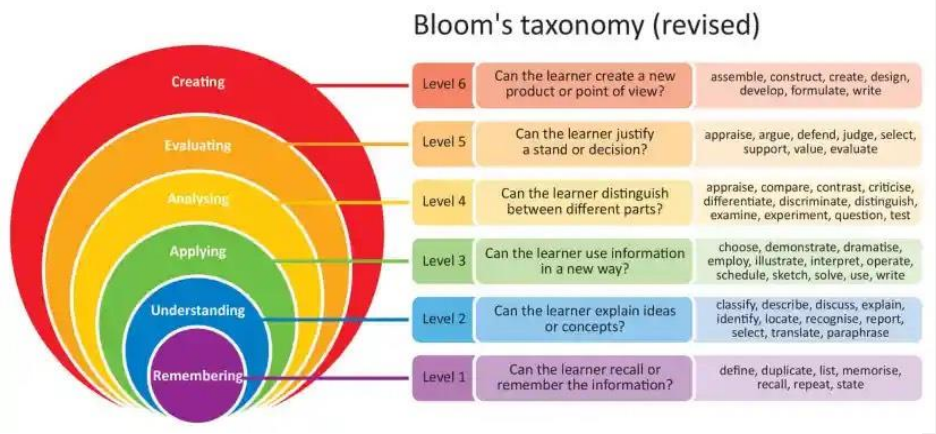


FIGURE 1: REVISED BLOOM'S TAXONOMY (MCNULTY, 2019)

As a follow up to the Honours study, I want to further explore learners' understanding of task words and subject terminology.

Grade 6 learners were chosen, firstly because grade 6 is the main grade which I teach. While the school is a South African Public school, learners at this school come from various nationalities such as South African, Zambian, Zimbabwean, Malawian, Nigerian and Congolese. Many of the learners come from disadvantaged socioeconomic backgrounds and are part of the school's government feeding scheme. Secondly, I believe that grade 6 is an important year as it is the end of the intermediate phase for learners, meaning that learners need to have a firm foundation of knowledge taught in intermediate phase in NST because when they enter grade 7 is senior phase, where NST becomes separated into two subjects Natural Science (NS) and Technology (Tech). This knowledge becomes crucial as the strands taught in NST are taught in a way that each topic progresses into the next concept across the grades and phases (Department of Basic Education, 2011). A learner is likely to perform inadequately in NST if they a poor understanding of NST concepts, subject terminology, and task words.

1.2. Problem Statement

Many learners struggle to answer questions adequately in Natural Science and Technology formative assessments. Some of their reasons are that they do not understand what the question is asking of them. Their lack of understanding hinders them from performing well in Natural Science and Technology formative assessments which in turn further prevents them from maintaining an interest in science as they progress to higher grades. Thus, this study aimed to

investigate learners' conceptual understanding of assessment questions, with particular attention to understanding of task words or key words, so that I can devise strategies to mitigate this.

1.3 Purpose Statement

The purpose of this study was to gain insights into grade 6 conceptual understanding of task words (used in Bloom's taxonomy) and key words (subject terminology), to help learners develop a conceptual understanding of task words and subject terminology used in Natural Science and Technology.

1.4 Research Objectives:

The research objectives of this study were:

1. To establish the task words and key words used in NST formative assessments on the topic 'Electric circuits'.
2. To establish learners' interpretation of task words and subject terminology in NST formative assessments on the topic 'Electric circuits'..
3. To compare learners' interpretation of task words and subject terminology with the intended meaning of these words on the topic 'Electric circuits'.

1.5 Research Questions:

My main research question was:

> What is grade 6 learners' understanding of task words (used in Bloom's taxonomy) and subject terminology in Natural Science and Technology formative assessments on the topic 'Electric circuits'?

My sub-questions were:

1. What are the task words and subject terminology that are used in grade 6 learners' Natural Science and Technology formative assessments on the topic 'Electric circuits'?
2. How do grade 6 learners interpret assessment task words and subject terminology used in Natural Science and technology formative assessments on the topic 'Electric circuits'?
3. How do learners' interpretations of task words and subject terminology compare with its intended meaning on the topic 'Electric circuits'?

1.6 Report Outline

In chapter 1, I discussed the introduction and background of this study along with the purpose and research questions that was further explored. In chapter 2, a literature review is provided in which relevant literature on Natural Science, assessment, conceptual understanding, task words and subject terminology is discussed with respect to my study. In chapter 3, the research design and methodology used is discussed as well as the research participants, instruments and the ethical considerations that were adhered too. In chapter 4, a data analysis of the results is given whereby I present these results and provide an interpretation of the research findings in this study. In chapter 5, a discussion of these results is provided, and relevant conclusions are drawn.

1.7 Conclusion

In this chapter, I presented a background to this study. I then briefly discussed the subject of natural science and technology which led to me questioning what assessment is according to CAPS including task words and subject terminology. I then explored the problem statement which focuses on learners' understanding of task words and subject terminology. Therefore, the problem statement led to the purpose of this study to investigate grade 6's understanding of task words (used in Bloom's taxonomy) and key words (subject terminology) with the aim of aiding learners to have a better conceptual understanding of questions being asked in formative assessments. Specific research questions were identified. In the next chapter, I will examine relevant literature on concepts of assessment, conceptual understanding, task words and subject terminology in Natural Science and Technology with respect to this study.

CHAPTER 2: LITERATURE REVIEW

2.0 Introduction

The purpose of this study was to gain insight on grade 6 learners' understanding of task words (used in Bloom's taxonomy) and key words (subject terminology), to help learners develop a conceptual understanding of task words and subject terminology used in Natural Science and Technology. In this section, I address critical questions by drawing on relevant literature to motivate for this study. Science and Technology will be discussed, followed by assessments, frameworks and learners' vocabulary and conceptual understanding.

2.1 Role of Science and Technology in society

Society has evolved to such an extent where many people are employed in jobs that are associated to science and technology (Rocard et al., 2007). In modern society, many people are employed in industries associated with science and technology. Therefore, it is vital for teachers to nurture a positive and acceptable attitude in learners towards science and technology (Rocard et al., 2007). Learners develop an attitude towards science and technology before the age of 14 years (Osborne & Dillon, 2008). Although, we make use of science and technology daily, there has been a decline in learners' interest towards science and technology subjects throughout the world more significantly in primary school (Gresnigt et al., 2014). Globally, different initiative programs have been implemented to increase the focus of science and technology in primary school education (Gresnigt et al., 2014). In Netherlands, "a project called VTB Program (Broadening Technical Education in Primary Education)" was implemented over 3 years to assist primary schools with incorporating science and technology into their teaching (Walma van der Molen et al., 2010). However, the study showed that primary school teachers tend to neglect teaching science and technology as they do not have adequate training to teach science and technology (Walma van der Molen et al., 2010). Primary school teachers are generalists whereby they are trained to teach a range of subjects from Mathematics to Social Sciences as compared to high school or secondary school teachers who are subject specialists (Gresnigt et al., 2014). The way science and technology is taught in primary schools across various countries also differs. "In England and the United States of America science and technology are taught as two separate subjects. Whereas in countries like Netherlands and France, science and technology are taught a one subject." (Gresnigt et al., 2014, p. 48). In South Africa, science and technology are taught as one subject called Natural Science and Technology until a learner is in grade 6 (Department of Basic Education, 2011).

2.2 What is Natural Science and Technology?

Natural Science and Technology (NST) is composed of two subjects: (1) Science and (2) Technology (Department of Basic Education, 2011). Across the world, people from various cultures and backgrounds have manipulated materials, techniques, and tools to assist in meeting their needs and wants (Orpwood & Werdelin, 1987). Orphwood and Werdelin explain, "… the basic needs of shelter, clothing, nourishment and physical survival, as well as the human desires for comfort, transportation, communication and military superiority, led to the development of technologies in many areas." (Orpwood & Werdelin, 1987, p. 10). As one generation learned about technology from their parents or the preceding generation, the current generation would make modifications to the traditional crafts they have learnt which proved to be satisfactory (Orpwood & Werdelin, 1987). Therefore, technological education developed which was independent from science and from the schooling system (Orpwood & Werdelin, 1987). However, when the study of science started to emerge, technology became highly dependent on scientific knowledge whereby technological education became less of a priority in schools (Orpwood & Werdelin, 1987). Learners who were more inclined to pursue home economics or craftsmanship such as metal work or wood word would attend technical schools compared to mainstream schools where science education became the priority. Despite this, technology is important as technology seeks to find solutions to society's problems by making use of knowledge, skills, and resources by creating a product to solve these issues (Department of Basic Education, 2011).

Compared to technology, "science seeks to find possible explanations as to why phenomena occur" the way it does and to connect ideas together (Orpwood & Werdelin, 1987, p. 11). Although technology is built from concrete materials that create the innovations used in technology, the foundation of science is built on ideas or concepts that humans have explored (Orpwood & Werdelin, 1987). These ideas are explored in a hierarchical fashion. Firstly, science will find ways to describe objects or phenomena. This is done through the development of concepts which aim to explain why the object or phenomena occurs in a particular way (Orpwood & Werdelin, 1987). Investigations and inquiry methods are used to explore these possible explanations and these methods should be able to be replicated (Department of Basic Education, 2011). Secondly, science will then make connections between the concepts to classify the object or phenomena into groups (Orpwood & Werdelin, 1987). Therefore, in the more recent years combining science and technology has become important as in many newer

cases of technology, the knowledge obtained from science is necessary for technological innovation (Orpwood & Werdelin, 1987).

By incorporating both science and technology into one subject NST, learners at an intermediate phase level as early as grade 4 are provided with the opportunity to understand how the natural world functions (Department of Basic Education, 2011). Therefore, NST is a crucial subject to be taught as NST is the foundation of how learners will understand and explore the world around them. NST provides insight for learners to make meaning of the natural world around one as well as the need for objects made by humans to find solutions to problems.

In South Africa, NST aims to achieve three specific aims:

1. Learners must be able to conduct investigations and practically solve problems which will cause them to adopt certain values and skills such as having respect for others (Department of Basic Education, 2011).
2. Learners need to be able to draw understanding and connect concepts taught in NST by applying their knowledge of what has been taught to new situations instead of only memorizing facts (Department of Basic Education, 2011). This can be reinforced through discussions dealing with learners' prior knowledge and how they join new ideas taught.
3. Learners need to understand and observe that NST is not confined to the classroom only, however it forms part of their daily lives in their homes, community, and society (Department of Basic Education, 2011). This should cause them to appreciate science and become active citizens that want to bring about change in society. In turn result in them pursuing possible careers in science or technology.

These three aims depend greatly on a learner's understanding of NST. A learner's understanding is evaluated and assessed using assessments. These assessments occur in different forms and occur throughout the four terms in the schooling year.

2.3 Assessment

2.3.1 What is assessment?

According to the Curriculum and Assessment Policy Statement (CAPS), "assessment is a continuous planned process of identifying, gathering, interpreting and diagnosing, information about the performance of learners" (Department of Basic Education, 2011, p. 65). Assessment allows teachers to gain insight into the teaching and learning taking place in their classrooms.

There are two purposes of assessment: Formative and Summative Assessment (Black & Wiliam, 2009). It is important to note that formative and summative assessments are not different types or forms of assessment, however, they perform different purposes of assessment (Dolin et al., 2018). The main purpose of formative assessment is for learners to learn whereas the main purpose of summative assessment is to supply information as to what learning has been obtained at that specific time of the assessment (Dolin et al., 2018).

2.3.2 What is formative assessment?

Formative assessments are informal assessments. According to Black and Wiliam (2009, p. 9), "formative assessment is the extent that evidence about student achievement is elicited, interpreted, and used by teachers, learners, or their peers to make decisions about the next steps in instruction that are likely to be better, or better founded, than the decisions they would have taken in the absence of the evidence that was elicited." (Black & Wiliam, 2009, p. 7). This shows that formative assessment should aid teachers in the direction in which teaching, and learning is happening. Black and Wiliam (2009, pp. 4-5) indicate five key strategies of formative assessment:

1. explain and explicitly share objectives of learning intentions.
2. enabling learners to participate in classroom discussions to explicitly show what they understand
3. feedback given to learners to aid in their success for learning
4. using "learners as instructional resources for one another" (learners can learn from their peers) (Black & Wiliam, 2009, p. 5)
5. allowing learners to self-assess themselves by being owners of their own learning processes.

Therefore, the purpose of formative assessments is to regulate the learning process in learners and is known as assessment for learning (Black & Wiliam, 2009). Importantly, formative assessments provided critical information to the teacher as feedback of learners understanding and direction in which teaching and learning should occur (Dixson & Worrell, 2016). Although formative assessments can be scored or allocated marks (e.g., on a worksheet or tests), the evaluation of the assessment or the marks obtained from the assessment will not be taken into consideration because the focus is not on the marks but rather learners understanding and how effective teaching has been (Dixson & Worrell, 2016). Spontaneous formative assessments and planned formative assessments are two forms of formative assessments (Dixson & Worrell,

2016). Spontaneous formative assessments are improvised for example (a) when a teacher observes misunderstanding in a learners' body language and questions the learner about their understanding, (b) when a learner is asked to provide an example or answer a question to related to a concept taught or (c) when questioning and answering occurs during the lesson either from the teacher or learners (Dixson & Worrell, 2016). In these lessons the teacher is supplied with information as to learners learning at that specific time. For example, in a NST practical task if the teacher observes that a learner's electric circuit is not working correctly, the teacher can guide the learner to manipulate the wires and check if all the relevant connections are made correctly. Planned formative assessments are worksheets, quizzes and homework activities that help assess learners progress (Dixson & Worrell, 2016).

A fundamental component of assessment for learning is feedback. This feedback can occur, according to Dolin et al. (2018), is "consistent with the social constructivist view of learning whereby feedback is from student to teacher, from teacher to student or from student to student" (Dolin et al., 2018, p. 58). The purpose of feedback regardless of whether it is written or given orally is to provide the learner with information on how they can improve their learning (Dolin et al., 2018). As seen in the example, whereby a teacher provides feedback to learners during the construction of an electric circuit, learners obtain information that his or her circuit was not working correctly due to the connections of the wires. Thereafter, the learner would manipulate his or her electric circuit to determine what was the cause of the problem and find a solution through the assistance of his or her teacher or colleagues in the class. If marks were only given, this would not assist learning. A study conducted by Bulter (1988) showed that learning was more effective when learners received only comments during feedback compared to receiving marks with or without comments (Butler, 1988). Dweck (2000) revealed that feedback which incorporates marks has a negative impact on a learner's ability to learn (Dweck, 2000). When a learner sees a mark, they tend to focus on the mark and neglect the comment (Dweck, 2000). However, a mark given does provide direction for a teacher as to what learning has occurred and how to plan future lessons.

Formative assessments allow for learning to occur socially and collaboratively (Dolin et al., 2018). However, it is important that learners are given time to reflect and internalise the feedback given as well as ample time to make amendments to their work (Dolin et al., 2018). Therefore, formative assessment is known as Assessment for Learning (Black & Wiliam, 2009). Thus, formative assessments are a crucial part of this study in gaining clarity on grade

6 learners conceptual understanding of task words and subject terminology to help them understand NST and perform better in assessments.

2.3.3 What is summative assessment?

Summative assessments are formal assessments (Earle, 2014). Summative assessments indicate a learner's progress in a subject by capturing their learning using marks or scores obtained in the formal assessment (Earle, 2014). Some examples of formal assessments in NST are tests, examinations, practical tasks such as investigations or projects (Earle, 2014). These assessments are not given as regularly as formative assessments which maybe be given daily, or weekly as summative assessments are assessments of learning (Dixson & Worrell, 2016). If the marks obtained by the learner is satisfactory for the teacher such as a pass mark or percentage, no more learning will occur on the content that was assessed in the summative assessment, unless the learner needs to wite a final examination (Dixson & Worrell, 2016). Summative assessments are used to assess whether a learner should be promoted to the next grade or not, or to give direction as to what career they should pursue or to determine if a learner qualifies to obtain an awards or achievements (Dixson & Worrell, 2016). Importantly, summative assessments can be used as formative assessments (Earle, 2014). Assessing learners using summative assessment allows learners to explain their conceptual understanding and allows learner to be given an opportunity whereby they can critically think to apply their understanding to explain problems (Dixson & Worrell, 2016). Therefore, what content is being assessed as well as how it will be assessed needs to be thought of carefully.

A teacher needs to carefully choose the appropriate assessment task as well as ensure that the cognitive demand of the assessment is applicable to the age and level of development of learning for learners within that specific grade (Department of Basic Education, 2011). Table 1 below shows the cognitive demands required in formal assessments according to CAPS (Department of Basic Education, 2011). Cognitive demands are met through the formulation of questions centred on concepts and subject terminology in NST as well as making use of useful verbs informed from Bloom's Taxonomy.

TABLE 1: PERCENTAGE OF COGNITIVE DEMANDS IN FORMAL ASSESSMENTS (DEPARTMENT OF BASIC EDUCATION, 2011)

Percentage of question paper:	Cognitive demand of questions:	Focus of questions on:

50%	Lower-order questions	How much learners know about science and technology (Department of Basic Education, 2011)
35 %	Middle-order questions	Learners' understanding of science and technology as well as their application of scientific and technological knowledge (Department of Basic Education, 2011)
15%	Higher-order questions	Evaluating, analysing, synthesising learners' scientific and technological knowledge (Department of Basic Education, 2011)

This study has chosen to call the useful verbs used, 'task words'. Therefore, seeks to investigate what are grade 6 learners' conceptual understanding of task words and subject terminology in NST. It is important to define what conceptual understanding is.

2.4 What is conceptual understanding?

The way in which learners answer questions and solve problems rests upon their knowledge, how they process various skills and the attitude they possess (Chang et al., 2010). Tests play an important role in assessment as well as determining how a learner's conceptual understanding has developed (Chang et al., 2010). Therefore, what s conceptual understanding? During teaching and learning, teachers may teach in a traditional passive manner whereby they may present a lecture or pass information from themselves to the learners without providing learners with an opportunity to engage with the content or other learners (Konicek-Moran & Keeley, 2015). After this process, when assessment occurs and should learners fail the assessment, these results indicate no understanding was obtained for the lessons taught (Konicek-Moran & Keeley, 2015). This is important as only teaching through communication such as talking or even including visuals such as diagrams or demonstrations, without determining if learners are making meaning of the content taught is futile as learners will only be obtaining information and not processing it (Konicek-Moran & Keeley, 2015). Learners need to engage with the content intellectually to develop their understanding (Konicek-Moran & Keeley, 2015). Many times, teachers allow learners to define subject terminology, complete activities and worksheets and answer low cognitive level questions which provide learners with

minimal engagement with content (Konicek-Moran & Keeley, 2015). Konicek-Moran & Keeley state that learners "may be able to reproduce the words or symbols she or he receives without understanding the meaning behind them or the power of using them to argue or predict and delve deeper into the ideas involved" (Konicek-Moran & Keeley, 2015, p. 2). In NST, learners may be able to define what an electric circuit is; however, they may not be able to explain the purpose or how an electric circuit works. Although, learners are memorizing content or can provide definitions, this understanding is literal understanding and not conceptual understanding (Konicek-Moran & Keeley, 2015). Learners need to be able to explain how everyday phenomena occur using their knowledge of basic concepts to possess for it to be considered conceptual understanding (Konicek-Moran & Keeley, 2015). This goes beyond recalling facts but rather to them applying their knowledge to new situations (Konicek-Moran & Keeley, 2015).

Secondly, concepts are abstract ideas or ideas about phenomenon (McComas, 2013). A concept can be a word or a phrase or a symbol but is the foundation of ones thinking (Konicek-Moran & Keeley, 2015). Concepts or abstractions are formed in a person's mind when someone wants to make meaning of what is occurring in the world (Konicek-Moran & Keeley, 2015). According to Konicek-Moran & Keeley for learners "to have an understanding of a concept, they need to be able to: (a) think with the concept, (b) use the concept in areas other than that in which they learned it, (c) state the concept in their own words, (d) find a metaphor or an analogy for the concept, or (e) build a mental or physical model of concept" (Konicek-Moran & Keeley, 2015, p. 6). Thus, conceptual understanding is when learners have internalised the concept and possess it as their own (Konicek-Moran & Keeley, 2015).

Conceptual understanding is important as teachers make use of concepts to direct learners thinking process within a topic (McComas, 2013). Within the Topic: Electricity in this study, concepts taught include electric circuits, conductors, insulators etc (Department of Basic Education, 2011). It is within these concepts that learners conceptual understanding of subject terminology will be explored in this study. McComs (2013) elaborates that conceptual understanding is when a learner has a deep understanding of the concept that was taught to them (McComas, 2013). They can relate the concepts to facts and topics taught and make inferences by applying their knowledge to new situations (McComas, 2013). Conceptual understanding is important as this study seeks to explore whether learners have a deeper understanding of task words and subject terminology or if they are only memorising these

concepts. This finding will be important to be able to compare how grade 6 learners interpret task words and subject terminology with the intended meaning of these words in CAPS.

Therefore, a crucial part to this study is understanding what task words are.

2.5 What are task words?

As mentioned in Chapter 1, in 1956, Bloom's taxonomy is a framework to categorise ones thinking based on six cognitive levels that increase in complexity (Forehand, 2011). In 2000, the framework was revised by David Krathwohl (Sivaraman & Krishna, 2015) which will be used in this study as seen in Figure 1 (Chapter 1). According to Sivaraman & Krishna (2015), the purpose of using Bloom's taxonomy is:

1. The taxonomy allows teacher to think about the type of questions they will use in an assessment.
2. The taxonomy provides a clear direction with a specific objective for questions which are formed by the examiner.
3. The taxonomy assists teachers in setting a well-rounded and balanced assessment as any learners may argue about the difficulty or easiness of the test paper.
4. The taxonomy allows teachers to be consistent throughout questions and assessments.

Bloom's taxonomy assists teachers by providing them with specific verb words or task words that addresses a particular cognitive level that a learner should have developed (Paleeri, 2015). Task words are used to describe to the learner what skills and learning outcome the teacher expects from them in the question (Stanny, 2016). The relationship between cognitive demands, task words and expectations of learners are illustrated below in Table 2.

TABLE 2: TASK WORDS AND EXPECTATIONS OF LEARNERS (ARMSTRONG, 2010) (DEPARTMENT OF BASIC EDUCATION, 2011)

Bloom's level:	Cognitive Domain:	Task words:	Expectation of learner:
1.	Remembering	State, name, define, list, memorise	To remember and recall basic facts or concepts (Armstrong, 2010)

2.	Understanding	Classify, describe, explain, identify, select, recognise	To explain concepts (Armstrong, 2010)
3.	Applying	Demonstrate, compare, predict, sketch,	To use existing knowledge and apply it to new situations (Armstrong, 2010)
4.	Analysing	Compare, distinguish, examine, differentiate, organise, test, question	Make connections amongst concepts and ideas taught (Armstrong, 2010)
5.	Evaluating	Select, support, argue, defend, evaluate	To justify or argue a decision made (Armstrong, 2010)
6.	Creating	Design, construct, investigate, develop	Produce new or original work (Armstrong, 2010).

The purpose of Table 2 is to explicitly show which specific task words are used in CAPS in formative assessments and why these task words are used. An example of the implementation of these task words would be in a NST practical task, learners are required to design and construct a model of their choice whereby they need to include an electric circuit to their model. Learners would go through a process whereby they would have to list the material or tools needed. Then progress onto describing and apply their knowledge as to how they would use each material and tool in their construction process of the model and draw a design of their model. Thereafter, they would have to construct the model and analyse whether their model was same as their design. This will probe them to evaluate their model and what could improve next time. Although these task words are crucial in assessments, and they are included in CAPS according to Table 2 within CAPS there is no time allocated for a teacher to explain to learners the meanings of these task words for learners to gain clarity on what the question is asking of them. Learners therefore often have no knowledge of what the definitions of these task words. It is also not enough for a teacher to define task words verbally as he or she needs to link the task words to specific content and subject terminology. Thus, this study seeks to determine

what are learners' interpretation of the task words used in formative assessments to enable learners to better understand task words and in turn help them perform in formative assessments.

2.6 What is subject terminology?

Science concepts are communicated through language, however scientific language is not the same as colloquial language (Konicek-Moran & Keeley, 2015). As previously mentioned in Chapter 1, according to McComs, "Academic Language in Science is the formal, precise terminology used in discipline-or domain-specific ways by those fluent or literate in that discipline" (McComas, 2013, p. 2). Therefore, in my understanding academic language in science equates to subject terminology as learners are required to read, write, speak, listen, and interact with specific language (words) in the discipline of NST (McComas, 2013).

Subject terminologies are derived from the CAPS document and the Annual Teaching Plan which is a document that lays out the concepts and curriculum coverage per term. This is further reinforced in textbooks which define key words within a topic. A study in Germany showed that it is through reading and learning associations that subject terminologies are cognitively derived and grow into concepts (Härtig, 2014). Subject terminology is vital in my study as subject terminologies have specific meanings which learners may have their own conceptions about. In NST, the concepts are developed cognitively from one grade to the next. Learners may also struggle with the complexity of scientific terminology that is used in NST which may overwhelm learners and hinder their learning (Härtig, 2014). Thus, learners need to have a correct understanding of the subject terminology they are interacting with as this may impact their performance in assessments and NST.

Subject terminology also relies on language that is spoken and learnt. A word that is used in NST may not have the same meaning to the use of the word in everyday language (Konicek-Moran & Keeley, 2015). Science teachers need to be conscious of the meanings of both scientific words and the same words used colloquially as learners may use them interchangeably which will impact their conceptual understanding of subject terminology (Konicek-Moran & Keeley, 2015).

Another issue is that scientific language is linked to learners experiencing science through practical investigations or experiments (Konicek-Moran & Keeley, 2015). For learners to learn the subject terminology conceptually they need to experience the language practically as well (Konicek-Moran & Keeley, 2015) which is an issue in South Africa due to the inequality of

resources at schools. Learners demonstrate their conceptual understanding through their vocabulary. Therefore, it is important to explore the subject terminology used in NST and the meanings learners draw from these terminologies. Therefore, this study seeks to compare learners' interpretation of subject terminology with the intended meaning of these words.

2.7 Science Vocabulary

For learners to explain their conceptual understanding, they need to have a deep understanding of vocabulary (Parsons & Bryant, 2016). In Science specifically, to understand and learn the language of science, learners need to possess certain vocabulary and be allowed opportunities whereby they can express themselves using this vocabulary (Parsons & Bryant, 2016). However, to teach learners such vocabulary, teachers need to scaffold opportunities whereby learners can be exposed to scientific vocabulary in a manner that is supportive and meaningful (Parsons & Bryant, 2016). Vocabulary can be developed through (1) conversations whereby learners have to answer scaffolded questions using specific vocabulary which will allow learners to construct knowledge for themselves (Parsons & Bryant, 2016); (2) peer conversations which occurs in class allows learners to practice using scientific vocabulary in a safe classroom environment (Parsons & Bryant, 2016); (3) book-based vocabulary whereby learners are given opportunities whereby they can read scientific vocabulary (Parsons & Bryant, 2016) which can be done through reading of textbooks or scientific books. However, it is important to note that words are classified or categorized in a particular hierarchy. "Words may be categorized by parts of speech, or form class, such as nouns, verbs, and so forth" (Parsons & Bryant, 2016, p. 379). Nouns are taught to learners at an elementary level by the teacher showing learners an object and learners associating that label with the object (Parsons & Bryant, 2016). Verbs are actions that are tangible to learners making it easier to understand verbs (Parsons & Bryant, 2016). However, words like adjectives are descriptors for nouns which are more complicated for learners to understand along with other classifications of words such as adverbs, conjunctions etc. (Parsons & Bryant, 2016). When these words are brought together in a relationship, a sentence is formed. Therefore, words and sentence structure are vital to learners conceptual understanding.

2.8 Understanding sentences.

A sentence is words grouped together to communicate an idea which can be done in writing or through speaking (Oshima & Hogue, 1991). Sentences are made up of clauses. Clauses are groups of words that form the foundation of a sentence as a clause contains at least one subject and a verb (Oshima & Hogue, 1991). Friti explains for learners to understand sentences learners

need to be able to have knowledge on "what sentences are about, what happens in the sentences and what other specific information is written in the sentences" (Fitri, 2017, p. 65). Therefore, it is vital for learners to be able to identify the important ideas, the less important ideas, and details of sentences (Fitri, 2017). According to McWhorter learners need to approach a sentence in the following way:

1. Firstly, the key idea needs to be identified. A key idea consists of a subject and a verb (McWhorter, 1992). The subject is a noun. A noun is a person or subject in the sentence (McWhorter, 1992). The verb of the sentence explains to learners what the noun (person or subject) is doing (McWhorter, 1992).
2. Secondly, learners need to locate what the main idea of a sentence is and what affect the main idea will have on the subject and verb (McWhorter, 1992). By identifying the details, learners will be able to understand what meaning the details are giving to the subject or verb for example such as where, what, how, when or why etc. (McWhorter, 1992).
3. Thirdly, learners need to determine the less important idea. The less important idea will describe the key idea and will always accompany the key idea as the less important idea cannot be a sentence on its own (McWhorter, 1992). The less important idea is always related to the key idea.

By using these approaches or identifying these components learners will be able to understand sentences better (Fitri, 2017). Although there are different types of sentences such as compound sentences and complex sentences, for this study we will only look at simple sentences. Understanding sentences and being able to identify the nouns, verbs, and less important ideas is vital in this study as assessments include sentences and questions. Learners should be able to easily use the approaches mentioned earlier to determine what the question the assessment is asking them. Therefore, the way a learner approaches an assessment question is important for them to make meaning of what is being asked of them. Thus, theoretical frameworks were chosen for this study.

2.9 Theoretical Framework

For this study to achieve the intended objective, there needs to be a foundational theoretical framework. The theoretical framework forms the foundation that the study will be based on, providing a guide on how to structure the study (Osanloo & Grant, 2016). The theories selected will be drawn on throughout the study to make relevant relations between the research

questions, the literature review, the methodology, the results, and findings, with the underpinning framework (Osanloo & Grant, 2016). The theoretical framework of this study is Cognitive Academic Language Proficiency (CALP) (Cummins, 2008) and Constructivism which will be further explained.

2.9.1 Cognitive Academic Language Proficiency (CALP)

The language used in our daily lives such as our conversations with family, friends and colleagues or our informal interactions are known as Basic Interpersonal Communication skills (BICS) for example the fluency of our conversations (Cummins, 2008). The language that teachers use in the classroom which allows for understanding and discussion of content is known as Cognitive Academic Language Proficiency (CALP) (Cummins, 2008). BICS consists of face-to-face conversations, and it allows the listener to observe people's facial expressions, body language and gestures to gather information of the context of the conversation (Cummins, 2008). Therefore, BICS is context-embedded and cognitively undemanding as the use of everyday language enables learners to understand the language easily (Cummins, 2000).

CALP is context reduced as it is the language children obtain from school whereby, they express themselves orally and in writing to be promoted to the next grade (Cummins, 2008). Cummins explains that BICS develops quicker in children than CALP does, however a learner will be challenged academically if he does not have CALP (Cummins, 2000). Cummins continues to explain that learners understand better using "action and experience" compared to a teacher and learner's interaction with texts (Cummins, 2000, p. 65). CALP is examined using assessments. Therefore, CALP is cognitively demanding as the vocabulary used is specialized to the subject by causing learners to use their "higher order thinking skills such as hypothesizing, evaluating, classifying etc." (Cummins, 2008, p. 76) as seen with the use of subject terminology and science vocabulary. When a learner performs well on a test, this learner is known to have CALP on the content which is being assessed (Aukerman, 2007). CALP is important for this study as this study aims to determine what are learners interpretations of the task words and subject terminologies. Task words and subject terminology are cognitively demanding words as they relate back to academics that learners are taught compared to their everyday language or the context in which they are in.

Learners can gain vocabulary through contextual situations. Gee (1990) proposed that primary discourses, which are attained from face-to-face interactions within the home, and secondary

discourses, which are attained from social institutions such as schools, religious places of worship, business and cultural settings, allows one to obtain vocabulary and language based on context (Cummins, 2008). As a learner's conversational language may be different from their academic language (Cummins, 2008). For example, some learners may fluently read in English, however they may not draw meaning or understand what they are reading (Cummins, 2008). This is a major problem for my learners when I assess them through formative assessments. Before formative assessments are given, learners are taught using constructivism.

2.9.2 Constructivism

Constructivism is based on the foundation that students learn new information by building information on knowledge that they already possess (Bada & Olusegun, 2015). Learning for each learner is influenced by the context of which the content is taught and learners beliefs and attitudes about what is being taught (Bada & Olusegun, 2015). Learners construct knowledge through their daily interactions and experiences (Bada & Olusegun, 2015). Therefore, when content is being taught to learners, they continually are building knowledge on content that has been previously taught (Bada & Olusegun, 2015). Prior knowledge plays a vital role in knowledge construction. Teachers need to ensure that they are tapping into learner prior knowledge to determine what mental models learners already have (Jones & Brader-Araje, 2002). If teachers do not tap into what learners have previously obtained, learners can build knowledge on information that may be in correct, and this can hinder their ability to conceptually understand content. When learners have preconceptions that are incorrect, children struggle to break down those existing mental models (Jones & Brader-Araje, 2002). Teachers must convince leaners that their understanding is incorrect and only when the learner is fully convinced that is when the child will neglect their incorrect understanding and construct new knowledge for themselves (Jones & Brader-Araje, 2002). In most cases, leaners do not fully neglect their incorrect mental model but rather hold onto their incorrect understanding while accepting the new correct information (Jones & Brader-Araje, 2002). Teachers achieve constructivism by making use of questions in their lessons and rather being a facilitator instead of being the only one possessing knowledge (Bada & Olusegun, 2015). The lesson is interactive whereby learners are actively communicating and learning from their social experience with others (Bada & Olusegun, 2015). Teachers encourage learners to constantly examine if the activity they are participating is in assisting them in understanding. Assessments in constructivists classroom includes learners work, the observations they make, their opinions on a what is being taught and tests as well. Therefore, constructivism has been used as

framework of this study to determine what are learners conceptual understandings of the task words and subject terminology used in formative assessments.

2.10 Conclusion

In this chapter, I reviewed relevant literature to this study on Natural Science, assessments, conceptual understanding, task words and subject terminology to name a few. The theoretical frameworks of CALP and Constructivism was laid out. Learners conceptual understanding of the task words and subject terminology used in NST formative assessments may vary. Therefore, an appropriate research design and methodology needs to be chosen. The research design, methodology and the data collection process will be discussed in detail in the next chapter.

Chapter 3: Methodology and Research Design

3.0 Introduction

In this chapter, I discuss the methodology used, the research participants and the research instruments that were used in this study. I also discussed the ethical considerations that were adhered to. The study investigated grade 6 learners' understanding of the task words (from Bloom's taxonomy) and the subject terminology used in Natural Science and Technology formative assessments. The main research question that guided this study was:

What is grade 6 learners' conceptual understanding of task words (used in Bloom's taxonomy) and subject terminology in Natural Science and Technology formative assessments?

The sub-questions that guided this study were:

1. What are the task words and subject terminology that are used in grade 6 learners' Natural Science and Technology formative assessments?
2. How do grade 6 learners interpret assessment task words (Bloom's) and subject terminology used in Natural Science and Technology formative assessments?
3. How do learners' interpretations of task words and subject terminology compare with its intended meaning?

3.1 Research Approach

This study made use of a qualitative research approach. Qualitative research allowed the researcher to gain clarity on real-life issues (Tenny et al., 2017). Qualitative research enabled the researcher to collect data on the experiences of the participants providing insight to research questions dealing with how and why certain phenomena occur (Tenny et al., 2017). The questions asked in a qualitative research approach focused on the 'how' and 'what' questions as seen during the semi-structured focus group discussions in this study compared to 'how much' which focuses on quantity as in a quantitative research approach (Tuffour, 2017). The qualitative research approach allowed me to obtain data of learners' experiences within a specific context (Tuffour, 2017). such as what was learners understanding of the task words and subject terminology used in their NST formative assessment. The approach, therefore, made use of open-ended questions (Tenny et al., 2017) which enable determination of thinking of the participants within a given context, through inductive analysis (Tenny et al., 2017).

Qualitative research also allowed for a deeper understanding into learners' insights and interpretations (Tuffour, 2017).

It is important to note that due to the context-specific nature of qualitative research, the results cannot be duplicated or experienced again (McLoed, 2019). Therefore, for researchers who want to replicate this study, the methodology can be duplicated, however, the results may differ as different research participants will be used and their responses in the interview will not be exactly replicated. Analysing qualitative data is also time consuming, due to time constrains many participants will not be able to participate in the focus groups (McLoed, 2019). Therefore, an appropriate paradigm needs to be chosen for this study.

3.2 Research Paradigm

An interpretivist paradigm was chosen as interpretivism is based on "how participants view the world through their perceptions and experiences." (Thanh & Thanh, 2015, p. 24). Interpretivism provides depth into understanding peoples interpretations of a phenomenon (Alharahsheh & Pius, 2020). By gaining deeper insights into peoples' interpretations allows the researcher to obtain valuable information on a particular phenomenon in a specific context instead of the researcher making a generalised law that is applicable to everyone (Alharahsheh & Pius, 2020). Context thus plays a crucial role in interpretivism because a learner's perception is constructed socially within a given context (Thanh & Thanh, 2015). The advantages of using interpretivism included understanding learners in their social context by using a case-study research design and the interviewer could make use of prompts in her questioning during the semi-structured focus group discussions to explore learners thinking, behaviours and feelings deeper (Pham, 2018). However, some criticism of interpretivism include although generalised laws cannot be obtained due to the research being content specific, some researchers question the validity or interpretivism (Pham, 2018). Another critique is that interpretivism is subjective to the interpretation of the researcher which can tend to be bias (Pham, 2018). Despite these critics, an interpretivist paradigm was the most appropriate research paradigm for my study as it enabled me to interpret what understanding learners draw from the task words and subject terminology used, in conjunction with a case-study research design.

3.3 Research Design: Case-study

A case-study method was the most effective research design to investigate grade 6 learners' conceptual understanding of task words and subject terminology in Natural Science and Technology formative assessments on the strand 'Energy and change and systems and

controls'. Case studies are based on constructivism the foundational principle of constructivism being social interactions which are observed through the interaction of the participant explaining their thinking to the researcher (Hafiz, 2008) (Noor, 2008). "Case studies also allow the researcher to explore or describe a phenomenon in context" (Hafiz, 2008, p. 546). The purpose of the case study is thus to provide "experience and evidence instead of providing generalisations" (Suryani, 2008, p. 118) and involves a group, such as the grade 6 participants in this study.

The strengths of making use of a case study include case studies supply ample details on the phenomenon being researched, it allows people to understand what other people are experiencing in a social context, the research setting is not manipulated in any way (Suryani, 2008). Some weaknesses that some scholars allude to case studies include the researcher being bias that influence how data is interpreted and other times the data is subjective to the participants responses (Suryani, 2008). Therefore, I as a researcher have tried to remain objective in terms of analysing the data and triangulation has been used to ensure that the data collected is not subjective. Although case studies are critiqued for a lack of research rigour and reliability, a case study has enabled me as the researcher to obtain a complete view of the phenomena being study (Noor, 2008).

3.4 Population

The population consisted of 101 enrolled grade 6 learners (3 classes consisting of between 33-35 learners per class) from a primary school in the residential area of Kempton Park based in the province of Gauteng. As mentioned in Chapter 1, learners at this school come from various nationalities such as South African, Zambian, Zimbabwean, Malawian, Nigerian and Congolese. Therefore, for many of them English is a second or even third language for them. Many of the learners come from disadvantaged socioeconomic backgrounds and are part of the school's government feeding scheme. All 101 learners participated in the formative assessment, class test. Thereafter, only 16 learners from the population of the 101 learners were selected to participate in the remainder of the study which took place in a classroom with only the 16 learners selected who were selected non-randomly and their gender did not influence the selection process. These 16 learners were selected according to their marks obtained in the written assessment into four focus groups: the highest scores, the average scores, the lowest scores, and a group with mixed scores. A sample size of 16 learners was chosen because the transcription process is very time consuming, and many learners did not feel comfortable to participate in the focus group interviews. Despite wanting more learners to participate in the

focus group interviews, only 16 learners were selected for the sample size. The sampling size procedure is described in detail in Section 3.5 below.

3.5 Sampling size and procedure

Firstly, quantitative data was collected from 101 grade 6 learners writing a formal assessment in the form of a class test (see APPENDIX A) which was assessing specific task words and key words. Purposive sampling was used. Purposive sampling has been chosen because this technique allowed me to narrow down my selection of learners to obtain information based on specific criteria (Palinkas et al., 2015). Such criteria included learners' performance on the class test and their interpretation of the task words and subject terminology used in formative assessments. There after 16 learners were selected based on their performance, consent obtained from their parents and their assent. Two of the 16 learners could not participate in the focus group discussions due to a death in the family and a medical illness that was contracted. Therefore, the final sample size was 14 learners. These learners were clustered into 4 groups according to their score based on the scores obtained from the class test throughout the grade:

- 4 learners who performed the highest scores,
- 3 learners who scored average scores,
- 3 learners who score the lowest scores,
- 4 learners which incorporates a mixed group of high, average, and low scores.

Each group participated in a focus group interview carried out by a fellow teacher in the school, Mrs X. Mrs X made use of an interview schedule provided to her (see APPENDIX B) to collect qualitative data. Mrs X was chosen to conduct the discussions to prevent bias data as the learners who are participants are the learners that I teach, and I aimed to remain objective throughout the study. The questions asked in the interview centred around the main research question and the sub-questions as previously mentioned. Therefore, a semi-structured focus group discussion was used.

3.5.1 Data Collection Techniques

Various data collection techniques were used to improve the trustworthiness of this study, therefore increase validity of this study. The techniques were methods used to generate the data that was collected in the study. Validity of the study is based on trustworthiness by diminishing bias, the researcher being objective and having a broad perspective on the issue being investigated (Loughran, 2007). Therefore, using different techniques such as document

analysis of the CAPS document and the formative test, and a focus group interview, validity will be ensured.

3.5.1.1 Document Analysis - CAPS

The CAPS document was a vital component of the document analysis as the content and concepts section links with the assessment section which was used as a guiding framework to draw up a formative assessment for the learners to write. Teachers make use of the CAPS document daily to frame concepts they teach and to set formative assessments. However, learners are struggling to meet requirements of these assessments. Therefore, the CAPS document was analysed in terms of how much information is provided to teachers with regards to task words, and what subject terminology CAPS prescribes. Thus, I believe this case study was beneficial as greatly contribute to my understanding of my learners and the way I teach and set formative assessments.

3.5.1.2 Formative Assessment – Class Test

A formative assessment in the form of a short class test was used. The class test included a range of questions making use of task words from Blooms Taxonomy (Paleeri, 2015) and on subject terminology within the topic: Electricity and Electrical Conductors & Insulators (guided by CAPS). The topic Electricity and Electrical Conductors & Insulators was chosen to be assessed as the data collection was in Term 3 whereby learners were learning this topic in class which served as the most appropriate topic to assess after teaching and learning had occurred. It was out of a total of 20 marks. The test was moderated by the Head of Department at the primary school and then administered to the 101 grade 6 learners. A memorandum was used to mark the assessments to select the learners who formed part of the four different focus groups based on their performance. The marks obtained from the formative assessment was converted to a percentage to determine the performance of learners. For the formative assessment, the following percentages of cognitive demands was set according to Table 1 in Chapter 2, based on the guidelines provided by Department of Basic Education (2011). Thereafter, the class test scores were used to select learners for participation in the focus group discussions. Mainly, the learners' responses in the tests were analysed and trends were determined. These trends then informed the type of questions asked in the focus group discussions to provide depth in the data collection process.

3.5.1.3 Focus Group Discussion

A focus group is gathering a few people around a discussion 'focused' on a certain topic or a particular issue (Onwuegbuzie et al., 2009). A focus group discussion enabled me to collect data from a larger number of learners all at the same time compared to conducting individual discussions which may have been time consuming (Onwuegbuzie et al., 2009). The focus group allowed learners to feel less threatened and may have caused them to share their opinions more freely through their interactions with others (Freeman, 2006; Onwuegbuzie et al., 2009). The focus groups were conducted through semi-structured discussions carried out by Mrs X, the grade 4 & 5 NST teacher. A semi-structured discussion process was conducted with each focus group and the participant' responses were video recorded. The learners responses from the semi-structured discussion allowed Mrs X to make meaningful prompts that are relevant to the learners to obtain data on the phenomena being studied (Bearman, 2019). A semi-structured discussion in the focus group setting allowed the questions to be narrowed down to the topic being investigated (Rabionet, 2011). Compared to an unstructured discussion whereby learners may derail their responses from the focus questions (Rabionet, 2011). The interviewer was required to facilitate the discussions between participants (Freeman, 2006). Mrs X also made notes of any emergent question that arose to prompt learners thinking (Onwuegbuzie et al., 2009). The focus group discussions were video recorded by the interviewer assistant, Mr Z who also ensure that learners are seated on time, and he took notes of the discussions (Onwuegbuzie et al., 2009).

After the assessments were scored and the discussions were concluded, the initial results led me to wonder how learners had approached assessment questions. Although, they may not have understood what the task word or the subject terminology may have meant, they must have approached the question in a particular way. I therefore took focus group 1 for an additional interview which I personally conducted. I chose this group as they were the group who scored the highest, meaning that they possibly understood the assessment questions, the task words, and the subject terminology best. These learners from focus group 1 were asked questions based on how they approached assessment question through another semi-structured discussion. Part of this semi-structured discussion also included an intervention strategy. Learners were taken through a process whereby I asked them to identify the verb and the noun in each question. Through this process learners were able to see the importance of identifying a verb and a noun in an assessment question. Learners were then asked to rephrase the question to each other. Their responses in the semi-structured interview were video recorded by Mrs X.

3.5.2 Data collection instruments

To effectively make use of the data collection techniques, there are specific data collection instruments that were essential to guide the data collection process of this study and to obtain the best results.

3.5.2.1 Formative Assessment - Class Test

As previously mentioned, the class test was used to determine the learners who participated in the focus group discussions and determined the use of questions that was used in the interview schedule. Therefore, the class test was used both as a data collection techniques and tool.

3.5.2.2 Semi-structured Focus Group Interview - Interview schedule

An interview schedule (see APPENDIX B) was used to explore learners conceptual understanding of task words and subject terminology used in formative assessments. The questions in the interview schedule were open-ended for the focus group discussion. Learners were allowed to respond to the open-ended questions if when they felt willing enough to share their responses and they were not forced to provide an answer if they were not comfortable too (McIntosh & Morse, 2015). The researcher needs to be aware that open-ended questions can lead to a positive or negative direction (Bearman, 2019). The use of a semi-structured interview schedule allows the facilitator to deviate from the questions on the schedule to some degree (McIntosh & Morse, 2015). Therefore, the facilitator needs to be aware of the implications of their questions and prompts continually keeping in mind the focus of the study (Bearman, 2019). The facilitator made use by asking the same questions to each focus group in the same order to make it easier to compare learners responses from each focus group and to collectively determine the findings that emerge (McIntosh & Morse, 2015). Thus, the interview schedule guided Mrs X, as to what is required of her. I also informed Mrs X to with a brief context about the study to assist her prompts However, when her prompts deviated, she would make note of the probing and keep it constant throughout the other discussions conducted with the other focus groups.

3.6 Data Analysis

The data obtained from this investigation made use of inductive and deductive analysis. The video recordings of the focus group discussions were transcribed and through a process of coding, themes were generated, and relevant findings were made.

3.6.1 Inductive analysis - Constant comparison analysis

To understand learners' interpretations of the task words subject terminology, learners responses in the discussions were analysed inductively through constant comparison analysis. I made use of constant comparison analysis of the focus group discussions which occurred firstly by me open coding and grouping the data according to codes (Onwuegbuzie et al., 2009). I then further clustered these codes through axial coding into categories (Onwuegbuzie et al., 2009). Thereafter, I then selectively coded these categories into themes that have emerged from each focus group (Onwuegbuzie et al., 2009). Constant comparison analysis was the most effective analysis for my focus groups as it saved time and allowed me to depict the themes that emerge across the data obtained from the focus groups (Onwuegbuzie et al., 2009). Allowing me, as the researcher to reach data saturation (Onwuegbuzie et al., 2009). Therefore, the discussions were analysed inductively.

3.6.2 Deductive analysis

Deductive analysis is a process whereby data is analysed based on a model or theory that is already formed (Elo & Kyngas, 2008) . The CAPS document was deductively analysed to determine what task words and subject terminology are used with their relevant intended meanings. After the inductive analysis of the focus group discussions as mentioned above, this deductive analysis of the CAPS document enabled me to compare the intended meanings of the task words and subject terminology with learners' conceptual understanding of these task words and subject terminology. The underlying theoretical framework that guided this inductive and deductive analysis was constructivism as mentioned in Chapter 2. However, one needs to pay attention to the reliability and validity of the data obtained, as explained next.

3.6.3 Triangulation

Triangulation of data includes using a combination of methods or data analyses or investigators to decrease the insufficiency of obtaining results from a single approach (Thurmond, 2001). By triangulating data, triangulation rises confidence in the research findings, provides clarity on the phenomenon being investigated and enables the researcher to make meaning of the data in various ways (Thurmond, 2001). Importantly triangulation cannot reinforce a "flawed study" (Thurmond, 2001, p. 253). Nevertheless, triangulation was obtained through the various data collection tools used and the research questions the techniques are addressing as seen in Table 3 below. The analysis of the documents and interview schedule was validated through face validations when the interviews were being conducted and videos were observed during the transcription process.

TABLE 3: TRIANGULATION OF DATA

Research question:	**Data collection technique:**	**Relation to BICS & CALP**
1.What are the task words and subject terminology that are used in grade 6 learners' Natural Science and Technology formative assessments?	CAPS document analysis	Learners' cognitive academic language proficiency (CALP). The academic language used in NST assessments which is specialised to the subject.
2. How do grade 6 learners interpret assessment task words (Bloom's) and subject terminology used in Natural Science and Technology formative assessments to mean?	Formative assessment Semi-structured Focus group Interview	Learners' basic interpersonal communication skills (BICS). Learners everyday use of language that enables them to draw meaning of what has been taught.
3. How do learners' interpretations of task words and subject terminology compare with intended meaning of these words?	Semi-structured Focus group Interview CAPS analysis	BICS & CALP whereby both learners meaning of task words and subject terminology which may be drawn from the use of everyday language is compared to the meaning of these words academically

Ways to increase the trustworthiness is through triangulation, dependability, quality, and rigour, (Golafshani, 2003). Trustworthiness refers to defending your findings and ensuring confidence and assurance of results presented (Golafshani, 2003). Reliability refers to the consistency of being able to replicate the results of data and "validity refers to whether the means of measurement is accurate and measures what it intends to measure" (Golafshani, 2003, p. 599). However, it is challenging to determine the reliability and validity of qualitative studies. In qualitative studies, the reliability is referred to the dependability (Golafshani, 2003).

Dependability is achieved through examining the data through which in this study was achieved through the process of constant comparison whereby raw data was analysed, the reduced by coding and findings were made (Golafshani, 2003). Trustworthiness, quality, and rigour relate to the validity of data in qualitative studies (Golafshani, 2003). Rigor and quality are determined by the researcher remaining objective and examining the interactions that are socially constructed during the interview process (Golafshani, 2003). In this study I tried to remain objective when analysing data of discussions were conducted. Hopefully, trustworthiness, dependability, quality and rigour were achieved as will be discussed in Chapter 5.

3.7 Ethical Considerations

The participants in the study are children. Therefore, various ethical considerations were adhered to:

1. Voluntary participation. In no way were the grade 6 learners be forced to participate in this study. Learners were able to withdraw from the study if they feel threatened or uncomfortable in any way.
2. Informed consent. Consent and assent were taken from both parents and learners participating in the study. Both parties were made aware of the purpose of this study, how the results will be used and implications of this study.
3. No harm. No harm was implicated on the children either physically or emotionally such as stress or anxiety. Focus group discussions allowed learners to feel safe as they were responding in a group.
4. Confidentiality. Learners' personal information such as real names and date of birth etc. will not be divulged to any third party but was and will only be seen by the researcher. Due to the focus group discussions, learners' responses within the focus groups were known to each other.
5. Anonymity. Learners' identity was not divulged and was protected. In case of the interview's, pseudo names will be used during data collection and analysis sections.
6. Objectivity. Throughout the study, the researcher remained free of bias. Therefore, my HOD was chosen to moderate the class test to ensure that the assessment is appropriate for the age of the learners. When the focus group discussions were conducted, Mrs X was chosen to ensure objectivity of the data collection from the discussions.
7. Appropriate language. No discriminatory or vulgar language was used.

I sent a letter to the school requesting permission to conduct this investigation at the school. Once this approval was obtained, the above ethical considerations was sent to the Department of Basic Education to obtain ethics clearance and it was approved. Ethics approval from the university to carry out this investigation was also obtained. Both learners and parents of the learners participating in the study were asked permission to participate in the study which allowed me to use the information they provide for research purposes. This process entailed me making both learners and parents aware of the ethical considerations discussed earlier. After parents and learners had given their consent and assent after being thoroughly informed of what the case study entails, how it will be conducted, purpose and implications of the study, I started the investigation process.

3.8 Conclusion

In any study conducted, the research design and methodology that was discussed in this chapter are an integral part of the investigation. I thoroughly adhered to this methodology as it is the foundation of my research, and it is the platform which sprang into the data analysis section of this study. In the next chapter, Data analysis will be explored in detail to obtain insight as to what were grade 6 learners conceptual understanding of the task words and subject terminology used in NST formative assessments.

Chapter 4: Data Analysis, Presentation, and Interpretation

4.0 Introduction

This chapter provides a description of the data analysis and the emerging research findings, linked to the research questions posed. The data analyses were informed by the main research question: What are grade 6 learners' conceptual understanding of task words (used in Bloom's taxonomy) and subject terminology in Natural Science and Technology formative assessments?

The sub-questions emphasized:

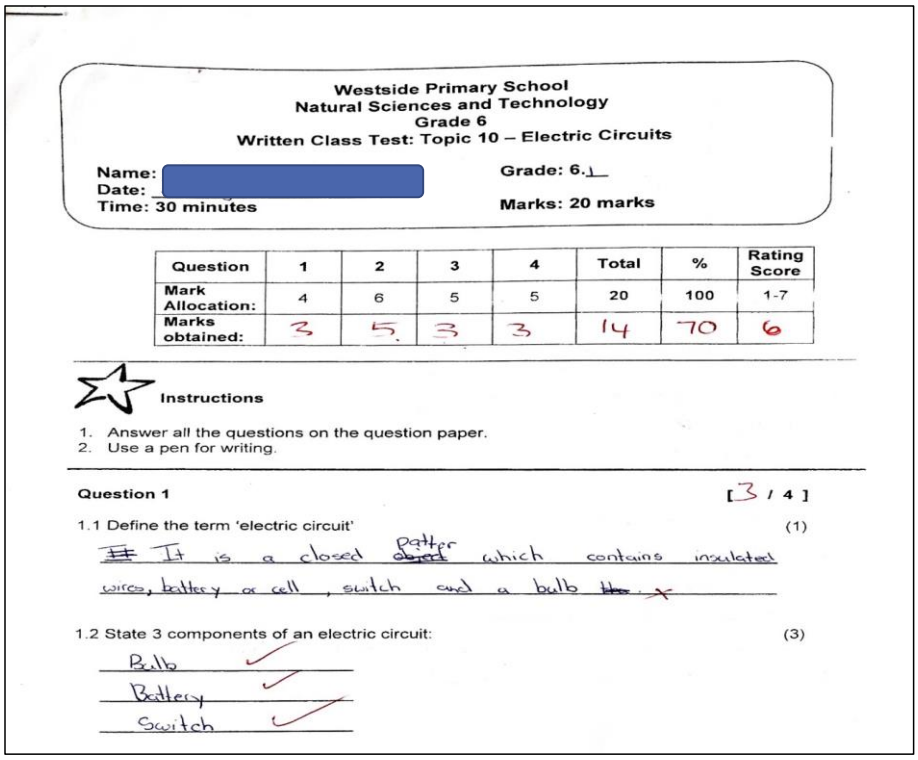
1. What were the task words and subject terminology used in grade 6 learners' Natural Science and Technology formative assessments?
2. How did grade 6 learners interpret assessment task words and subject terminology used in Natural Science and technology formative assessments?
3. How did learners' interpretations of task words and subject terminology compare with its intended meaning?

Data for this study were generated through a written test (101 learners) and four focus group discussions (14 learners).

4.1 Organisation of data for analysis

4.1.1 Analysis of tests

Analysis of the written test involved me marking a written assessment that the participants wrote. In total 101 grade six learners wrote the test. The tests were scored, and final mark was recorded, for each written assessment, as shown in Figure 2 below.



Westside Primary School
Natural Sciences and Technology
Grade 6
Written Class Test: Topic 10 – Electric Circuits

Name: [redacted]
Date: _____
Time: 30 minutes

Grade: 6.1
Marks: 20 marks

Question	1	2	3	4	Total	%	Rating Score
Mark Allocation:	4	6	5	5	20	100	1-7
Marks obtained:	3	5	3	3	14	70	6

Instructions

1. Answer all the questions on the question paper.
2. Use a pen for writing.

Question 1 [3 / 4]

1.1 Define the term 'electric circuit' (1)

It is a closed ~~object~~ pather which contains insulated wires, battery or cell, switch and a bulb ~~bb~~.

1.2 State 3 components of an electric circuit: (3)

Bulb ✓
Battery ✓
Switch ✓

FIGURE 2: EXAMPLE OF MARKED WRITTEN ASSESSMENT.

These scores from the written assessment are quantitative data which was presented in the form of tables as shown in Table 4 below. This table shows learner performance per question corresponding to a specific Bloom's level. This was done to provide information on learners performance per question to determine which cognitive levels of Bloom's Taxonomy (Forehand, 2011) learners struggled with. Table 6 further below also shows the learners' pass rate and failure rate based on a specific level of Bloom's Taxonomy. After the quantitative data was analysed, learners were selected based on their scores from the written assessment to participate in the focus group discussions. Four focus groups were determined based on: four learners who scored the highest, four learners who obtained an average score, four learners who scored the lowest and four learners who formed a mixed group whose scores ranged from the high to low.

TABLE 4: TASK WORDS USED PER QUESTION IN WRITTEN ASSESSMENT

Question:	Cognitive level:	Cognition:	Task word:
1.1	1	Remembering	Define
1.2			State
2.1	2	Understanding	Identify
2.2			Describe
2.3			Explain
3.1	1 3	Remembering Applying	Tabulate
3.2.1	4	Analysing	Predict
3.2.2	4	Analysing	Why
4.1.1	3	Applying	Compare
4.1.2	3	Applying	
4.2	5	Evaluating	Suggest

4.1.2 Analysis of discussions

Sixteen learners who wrote the written test, then participated in the focus group discussions. The purpose of the discussions was to gain a deeper understanding of what was learners' interpretation of the task words and subject terminology in the assessment. The four discussions were transcribed, and inductive analysis was done to understand learners' interpretation in assessments. Inductive analysis was conducted through constant comparison analysis of the focus group discussions as described in Chapter 3. Participants responses from each focus group was compared collectively to determine the themes that emerged. Once the discussions per focus group was transcribed, the transcriptions were inserted into a table per question and each of the focus groups responses was added (APPENDIX C). I was able to identify the patterns and draw conclusions as to what learners' interpretations were of the specific task word and subject terminology.

The blocks shaded in peach in APPENDIX C represent learners who were absent, while the blocks shaded in grey represent no response from learner. Different colours were then used to code learners' responses and themes appeared based on the code used. The themes allowed for

qualitative data to be obtained from the discussions conducted to inform my research findings. To make meaning of the data obtained from the discussions, an analysis had to be conducted on the CAPS document to determine the task words and subject terminology used in NST assessments.

4.1.3 Analysis of the CAPS document

To explore what task words and subject terminology is used in NST assessments for grade 6 learners, a deductive analysis of the CAPS document and the Annual Teaching Plan (ATP) was conducted. The document was analysed in terms of how much information does CAPS and the ATP provide teachers with to construct formative assessments and what guidance does it provide teachers with when they are assessing learners especially in terms of Bloom's Taxonomy (Anderson & Krathwohl, 2001). The CAPS document was amended during its implementation as many teachers, subject specialist and various stakeholders had numerous concerns about CAPS especially in terms of the lack of direction the document provides regarding cognitive levels in assessments (Department of Basic Education, 2019). Therefore, an abridged section has been amended to the Assessments Section, Section 4. According to the amended CAPS, there are a variety of task words that can be used in formative assessments according to their cognitive level which can be seen in APPENDIX D. The next section will focus on the task words and subject terminology used in the Grade 6 NST assessment.

4.2 Task words and subject terminology used in NST assessment.

4.2.1 Task words used.

According to the written assessment that the participants wrote, the following task words as seen in Table 4 above were used. Each task word used per question was used from the Amended CAPS and corresponded to a specific cognitive level from Bloom's Taxonomy (Anderson & Krathwohl, 2001) which was informed from the deductive analysis conducted on the CAPS as mentioned previously in section 4.1.3. I asked myself what topic will I assess? What cognitive levels needs to be assessed? How should the assessment be laid out. I decided, as mentioned in Chapter 3, to focus on the topic: electric circuits as learners were learning about this topic currently. The CAPS document provided a layout of the cognitive levels that should be addressed and the specific percentages of the cognitive levels that should be assessed throughout the assessment. 50% of questions should focus on lower-order questions, 35% of questions should focus on middle-order questions and 15% of questions should focus on middle order questions (Department of Basic Education, 2011). The written assessment (APPENDIX

A) was set according to these specific percentages. These cognitive levels assessed learners' cognitive abilities ranging from remembering to evaluating.

4.2.2 Subject terminology used.

To decide the subject terminology used in NST Formative Assessments, the revised ATP (see APPENDIX E) from 2019 was analysed. The revised ATP was used due to the COVID-19 pandemic whereby schools throughout South Africa had to implement the revised ATP from 2021 in the year 2022. The subject terminology used for the topic electric circuits varied, as seen in APPENDIX E. However, the following subject terminology (Table 5) was used in the written assessment.

TABLE 5: SUBJECT TERMINOLOGY USED IN THE NST ASSESSMENT.

Question:	Subject terminology
1.1	Electric Circuit
1.2	Components
2.1	Parts
2.2	Label
	Function
2.3	Circuit
3.1	Complete Circuit
	Incomplete Circuit
3.2.1	Light bulb
	Open Switch
4.1.1	Conductor
4.1.2	Insulator
4.2	Materials

The subject terminology focused on the topics: electric circuits and electrical conductors & insulators which is important for this study as learners struggle to understand concepts based on electric circuits. Having a proper understanding of the subject terminology may aid in assisting learners to understand assessment questions better. These task words and subject terminologies were used in the written assessment that learners were given. The test was used to determine the possible trends of which task words and subject terminologies were learners

in grade 6 finding challenging to interpret. Learners interpretation of the task words ad subject terminology will be discussed in detail below.

4.3 Learners interpretation of the task words and subject terminology

A total of 101 learners were given the written NST assessments and their outcomes per question were recorded. The test outcomes aided in determining learners' performance per Bloom's cognitive level, and the subject terminology that was used in the question. These trends were used as a guide to show me which task words and subject terminologies learners grasped and which of the words, they may have misinterpreted (Onwuegbuzie et al., 2009). The outcomes of the Grade 6 learners written assessment will be discussed below.

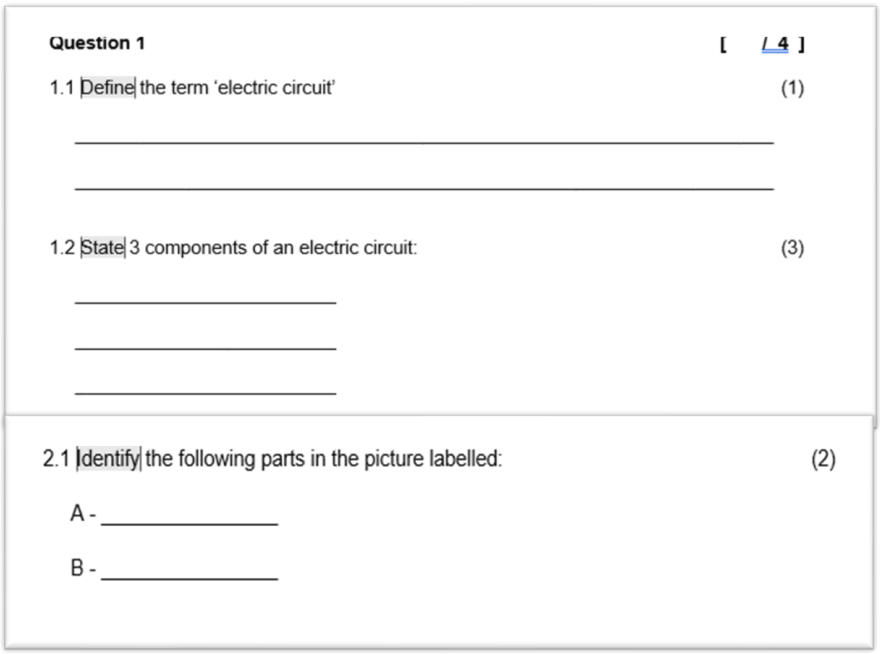
4.3.1 NST Assessment Outcomes

Table 6 shows the percentage of learners who passed or failed a question corresponding to a specific cognitive level from Bloom's taxonomy. The NST outcomes indicate that 76% of learners failed in remembering, 43% of learners failed in understanding, 88% of learners failed to tabulate and 76% failed to determine the differences, 90% failed in analysing, 67% failed in applying their knowledge, and 76% failed in evaluating. These findings are concerning as it is indicative that learners failed the written assessment showing that learners may not understand what was being asked of them in NST assessments or them may not understand the content.

TABLE 6: NST OUTCOMES PER QUESTION ACCORDING TO BLOOMS COGNITIVE LEVELS (N=101 PARTICIPANTS).

Question	1.1	1.2	2.1	2.2	2.3	3.1 (Tabulate)	3.1 (Difference)	3.2.1	3.2.2	4.1.1	4.1.2	4.2
Blooms Level	1	1	2	2	2	1	3	4	4	3	3	5
Pass Percentage (%)	24	96	95	57	56	12	24	62	10	43	33	23
Failure Percentage (%)	76	4	5	43	41	88	76	38	90	57	67	77

Interestingly, when observing the results for question 1.2 and question 2.1, although the questions are different as seen in Figure 3 and the questions address different cognitive levels, the pass rate trend was similar for both these questions.



Question 1 [/4]

1.1 Define the term 'electric circuit' (1)

_____

_____

1.2 State 3 components of an electric circuit: (3)

_____

_____

_____

2.1 Identify the following parts in the picture labelled: (2)

A - _____

B - _____

FIGURE 3: QUESTIONS FROM THE NST ASSESSMENT.

This finding shows that learners could understand the meaning of both task words 'state' and 'identify', although 'identify' was a higher cognitive level. Learners had a correct interpretation of the word resulting in them answering the question correctly. If question 1.2 is compared with question 1.1, both task words 'state' and 'define' requires the learner to remember. However, 76% of learners failed question 1.1 showing that they did not interpret 'define' correctly even though question 1.1 and 1.2 were basic level 1 cognitive questions. The question that arises in my mind are learners struggling with understanding the task word or are they rather struggling with the content, the subject terminology within the assessment questions? Therefore, this aspect needs to be explored further when an analysis of learners' interpretation of the subject terminology is explored.

Figure 4 below shows question 3.2.1 and question 3.2.2 in the written assessment.

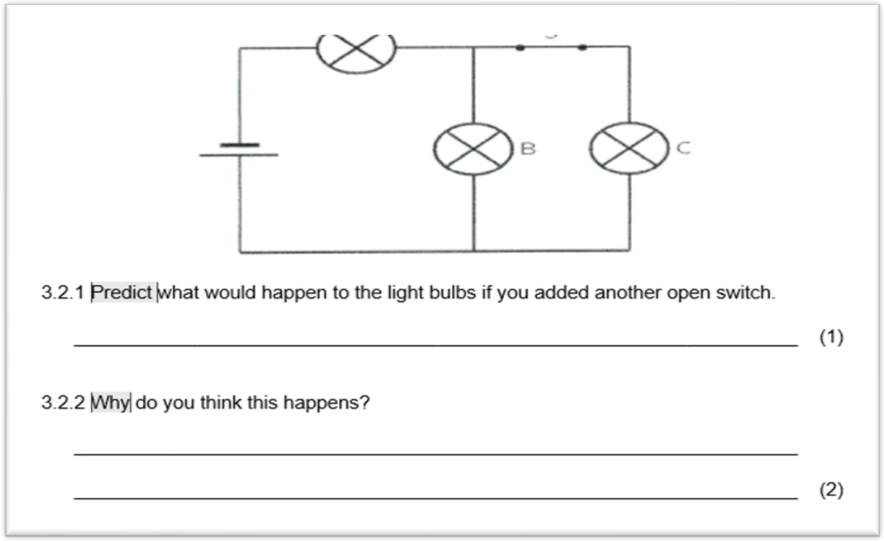


FIGURE 4: QUESTION 3.2.1 & 3.2.2 ADDRESSING LEVEL 4 IN BLOOM'S TAXONOMY.

Both questions were addressing a cognitive level 4 indicating that learners had to show how they analysed the diagram. However, according to Table 6, there was different pass rates for question 3.2.1 with 62% of learners understood how to 'predict' and question 3.2.2 only 10% of learners understood how to explain 'why' or provide a reason for their prediction "why means to give a reason". This finding shows that learners could not interpret 'why' correctly, as they interpreted 'why' as "why is something happening" or "why did this happen?" preventing them from further answering the questions correctly. Therefore, these findings indicate that learners' interpretation of the task word is vital for them to understand the assessment question. In the next section I will examine how the learners who were chosen to participate in the focus group discussions performed in the written NST assessment that all 101 participants wrote.

4.3.2 Focus Groups' NST Outcomes

As mentioned in Chapter 3, the focus groups were selected based on their scores obtained in the written test. Table 7-10 below indicate the outcomes of each focus group. Each focus group was formed based on their scores obtained in the written test assessments administered to all 101 participants. Once the assessments were marked and the scores obtained, I was able to select the learners who would participate in the Focus group discussions. The purpose of

analysing the test results of each focus group was to determine which assessment questions learners struggled with paying attention to specific cognitive level addressed in the question.

The NST outcomes for focus group 1 who obtained the highest scores (a score of 72% - 80% for the overall test) revealed that 100% of learners could remember, understand, and apply their knowledge according to the written assessments as shown in Table 7. However, all learners failed to tabulate, 25% failed to analyse correctly and 50% failed in evaluating as seen in Table 7. These outcomes are indicative that group 1 supposedly understood what was expected from them in the NST assessment and they understood the content.

TABLE 7: GROUP 1'S NST ASSESSMENT OUTCOMES PER QUESTION (N=4)

Question	1.1	1.2	2.1	2.2	2.3	3.1 (Tabulate)	3.1 (Difference)	3.2.1	3.2.2	4.1.1	4.1.2	4.2
Blooms Level	1	1	2	2	2	1	3	4	4	3	3	5
Pass Percentage (%)	100	100	100	100	100	0	100	75	75	100	100	50
Failure Percentage (%)	0	0	0	0	0	100	0	25	25	0	0	50

Focus group 2 was compiled of learners who scored an average of 45% for the test. Unfortunately, due to an illness participant 4 in group 2 did not participate in the focus group discussions as he was sick for the duration of the discussions. Therefore, only 3 learners participated in the interview for focus group 2. Table 8 shows that in focus group 2, the NST outcomes indicate that 67% of learners failed in remembering, 50% of learners failed in understanding, 100% of learners failed to tabulate. Surprisingly they all could differentiate, 100% failed in analysing and in applying their knowledge, and 33% failed in evaluating based on the written test results (Table 8).

TABLE 8: GROUP 2'S NST ASSESSMENT OUTCOME PER QUESTION (N=3)

Question	1.1	1.2	2.1	2.2	2.3	3.1 (Tabulate)	3.1 (Difference)	3.2.1	3.2.2	4.1.1	4.1.2	4.2
Blooms Level	1	1	2	2	2	1	3	4	4	3	3	5
Pass Percentage (%)	33	100	100	67	67	0	100	33	0	67	0	67
Failure Percentage (%)	67	0	0	33	33	100	0	67	100	33	100	33

Focus group 3 was compiled of learners who scored the lowest score for the test (an overall score of 15% - 38 % for the test). Unfortunately, due to a death in the family, participant 4 in group 3 did not participate in the focus group discussions as he was away for the duration of the discussions. Therefore, only 3 learners participated in the interview for focus group 3. Table 9 shows that in focus group 3, the NST outcomes indicate that 100% of learners failed in remembering, tabulating and differentiate, to analyse correctly. 67% of learners failed in understanding, applying their knowledge, and in evaluating. These results show that focus group 3 did not understand what was expected of them in the written assessment.

TABLE 9: GROUP 3'S NST ASSESSMENT OUTCOME PER QUESTION (N=3).

Question	1.1	1.2	2.1	2.2	2.3	3.1 (Tabulate)	3.1 (Difference)	3.2.1	3.2.2	4.1.1	4.1.2	4.2
Blooms Level	1	1	2	2	2	1	3	4	4	3	3	5
Pass Percentage (%)	0	0	67	33	67	0	0	33	0	33	33	33
Failure Percentage (%)	100	100	33	67	33	100	100	67	100	67	67	67

The NST outcomes for focus group 4 (who was compiled of a mixed group of low, average, and high scoring learners (a score of 25% - 70% for the overall test)) revealed that 75% of learners could not remember, differentiate, apply their knowledge and analyse correctly according to the written assessments as shown in Table 10. In terms of understanding, only 50% of learners in this group failed in understanding and tabulating. All learners failed in evaluating. These outcomes are indicative that group 4 supposedly did not fully understand what was expected from them in the NST assessment.

TABLE 10: GROUP 4'S NST ASSESSMENT OUTCOME PER QUESTION (N=4).

Question	1.1	1.2	2.1	2.2	2.3	3.1 (Tabulate)	3.1 (Difference)	3.2.1	3.2.2	4.1.1	4.1.2	4.2
Blooms Level	1	1	2	2	2	1	3	4	4	3	3	5
Pass Percentage (%)	25	100	100	75	50	50	25	75	25	25	50	0
Failure Percentage (%)	75	0	0	25	50	50	75	25	75	75	50	100

4.4 Comparison of learners' interpretation vs intended meanings.

For a comparison of learners' interpretations of the task words and subject terminology with its intended meaning I decided to address what the intended meaning of the task words are first. Importantly, although CAPS outlines the cognitive levels and task words used for each level from Bloom's taxonomy, there is no definition of what the intended meaning is for each specific task word. Therefore, I have used the Concise Oxford Dictionary to define these task words. Likewise for the subject terminology, CAPS nor the Annual Teaching Plan (ATPs) has the definitions of the subject terminologies used. Therefore, I have made use of the school's prescribed textbook, Grade 6 Platinum Natural Sciences and Technology textbook for the intended meanings.

4.4.1 Intended meaning of task words.

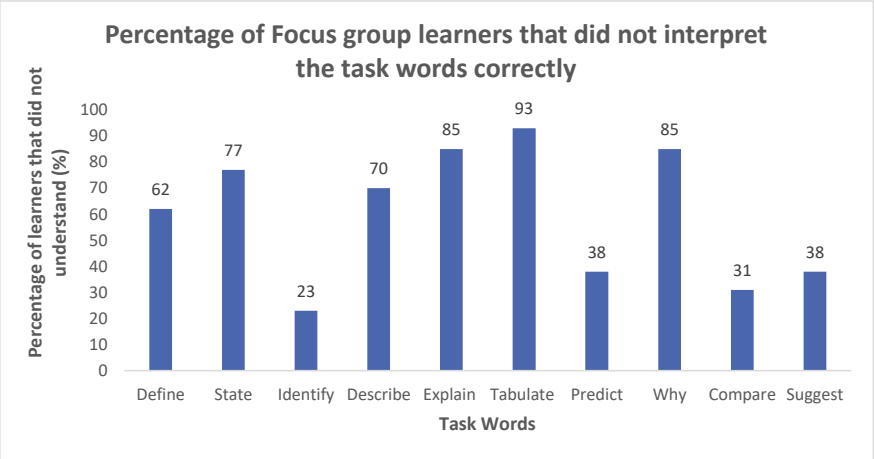


FIGURE 5: PERCENTAGE OF LEARNERS FROM THE FOCUS GROUP DISCUSSIONS WHOSE INTERPRETATION OF THE TASK WORDS WERE INCORRECT (N=13).

Figure 5 above shows the percentage of learners from the focus group discussions whose interpretation of the task words were incorrect when compared to the intended meanings of these task words.

4.4.2 Correctly interpreted task words

Task words such as 'identify', 'predict', 'compare' and 'suggest' were all correctly interpreted when compared to the intended meaning. 'Identify' means to "recognise or select by analysis" (Southern African Concise Oxford Dictionary, 2009, p. 573). To 'identify' something in an assessment question learners need to determine specifically what something is, and they may describe it if needed. Only 23% of learners interpreted 'identify' incorrectly. 'Predict' means to "state that will happen in the future" (Southern African Concise Oxford Dictionary, 2009, p. 919). Learners must decide an answer for what they think the outcome will be. 38% of learners misunderstood 'predict'. 'Compare' means to "estimate, measure or note the similarity or dissimilarity between" (Southern African Concise Oxford Dictionary, 2009, p. 234). As seen in Figure 5, only 31% of learners misinterpreted 'compare'. 'Suggest' means to "put forward for consideration" (Southern African Concise Oxford Dictionary, 2009, p. 1172). 38% of learners interpretation was incorrect. These results show that majority of the learners understood these task words.

4.4.3 Incorrectly interpreted task words

Figure 5 shows that task words such as ‘define’, ‘state’, ‘describe’, ‘explain’, ‘tabulate’ and ‘why’ were interpreted incorrectly as the percentage of learners who failed to interpret these task words correctly range from 62% to 93%. ‘Define’ means to “state or describe exactly the nature or meaning of something” (Southern African Concise Oxford Dictionary, 2009, p. 305). ‘Define’ relates to the writing the exact meaning. ‘State’ means “to express definitely or clearly in speech or writing” (Southern African Concise Oxford Dictionary, 2009, p. 1146). ‘State’ refers to supplying the main points without details. ‘Describe’ mans to “give a detailed account in words of (Southern African Concise Oxford Dictionary, 2009, p. 314). Learners must provide full details of what is being asked of them. ‘Explain’ means to “give a reason or justification for” (Southern African Concise Oxford Dictionary, 2009, p. 406). Learners need to provide reasons and in addition make use of examples to ‘explain’ something. ‘Tabulate ‘means to “arrange in a tabular form” (Southern African Concise Oxford Dictionary, 2009, p. 1192). Learners must answer the question by drawing a table with columns and rows and writing their answers inside the table. ‘Why’ means “for what reason or purpose” (Southern African Concise Oxford Dictionary, 2009, p. 1341). Learners need to provide a reason.

4.4.4 Learners interpretation of task words

Knowing the outcomes of the written NST assessment in all 101 participants and the 14 learners selected to participate in the focus group discussions, assisted the guidance of the semi-structured focus group discussions. As previously mentioned, each focus group interview was conducted, and learners interpretations were transcribed and inductively analysed. Below I will discuss the findings made from focus group participants interpretations.

4.4.5 Correct interpretations of task words

Task words that learners correctly interpreted according to the transcriptions were ‘identify’, ‘predict’, ‘compare’ and ‘suggest’. As seen in Tables 7-10 previously, learners passed the questions in the written assessment that dealt with ‘identify’ a level 2 cognitive question in question 1.2 (Figure 3) and ‘predict’ a level 4 cognitive question in question 3.2.1 (Figure 4). This shows in learners interpretations of ‘identify’ included “finding out what something is” to “knowing or saying what something is” during the discussions. Learners interpreted ‘predict’ as “to guess something’ or “to tell what will happen next”. Therefore, learners had a good understanding of the task words which enabled them to answer correctly.

4.4.6 Dependency of task words on subject terminology vice versa

The results from the discussions also show that the focus group learners interpreted 'compare' and 'suggest' correctly. Their interpretations of 'compare' was "finding the differences or similarities" and their interpretations of 'suggest' was "to give an idea or a reason". There interpretations were interesting because 'compare' is a level 3 cognitive question and 'suggest' is a level 5 cognitive question meaning that these task words are cognitively more demanding. However, if learners understood the meaning of the task words how did they fail the question in the written assessment? Could they have been struggling to understand the subject terminology? Looking at Figure 6 below which shows what was being asked of learners in these questions, learners knew what 'compare' and 'suggest' meant however, they could not apply this knowledge to the subject terminology. Therefore, this finding is important as it shows that learners need to have a good understanding of both the task word and the subject terminology for them to answer the assessment question adequately.

Question 4 **[/ 5]**

4.1 Compare the difference between a conductor and an insulator in the table below. (2)

Conductor	Insulator
4.1.1	4.1.2

4.2 Would you say it is important to know which materials are conductors and which materials are insulators? Suggest a reason to support your answer. (3)

_____

_____

_____

FIGURE 6: QUESTION 4.1 & 4.2 IN THE WRITTEN ASSESSMENT.

Interestingly, the focus group learners interpreted ‘state’ as “to name or label something”. Some learners even mentioned listing or saying something as seen in Table 11, showing that the focus group learners did not fully understand the meaning of ‘state’.

TABLE 11: DIRECT INTERPRETATIONS OF 'STATE' FROM LEARNERS IN FOCUS GROUP 1.

Questions	**Question**				
1.2	**What is the meaning of state?**	**Participant 1**	**Participant 2**	**Participant 3**	**Participant 4**
	Group 1	To name a type of term or object.	I would say it is to say.	State is to label.	

However, if we see Table 7 of the written assessment outcomes, 100% of learners passed the cognitive level 2 question which contained the word ‘state’. Looking at Figure 7, given the context of question 1.2, it is evident that learners looked at the subject terminology ‘components’ assumingly answered the question correctly by writing the 3 components of an electric circuit. Thus, this finding points to if learners do not understand the task word, they will look to the subject terminology to make meaning of the question. The opposite is also concluded that if learners do not understand the subject terminology, they will try draw understanding of the question from the task word used. Thus, learners interpretations depend on both the task word and subject terminology.

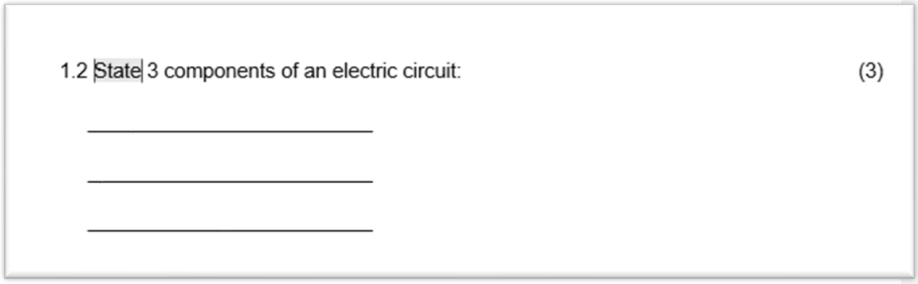


FIGURE 7: QUESTION 1.2 FROM THE WRITTEN ASSESSMENT.

4.4.7 Use of task word itself or another task word to interpret task word.

For task words such as ‘define’, “describe’, ‘explain’ and ‘why’ learners struggled to interpret these task words. ‘Define’ a cognitive level 1 question was interpreted as “to explain something” or “to describe something” or “to give the definition of something”. Learners said that to ‘describe’ (see Figure 8) is to “explain it or say how something functions” and some added “stating the appearance of the object”. Therefore, learners are using other task words to explain the task word being asked. ‘Explain’ was understood as “explain something” or ‘explain why by giving example” even though it was a level 2 understanding question. ‘Why’ was interpreted as “why is something happening” or “explain how something is”. Although these task words increase in cognitive demand, daily learners are asked these questions so they

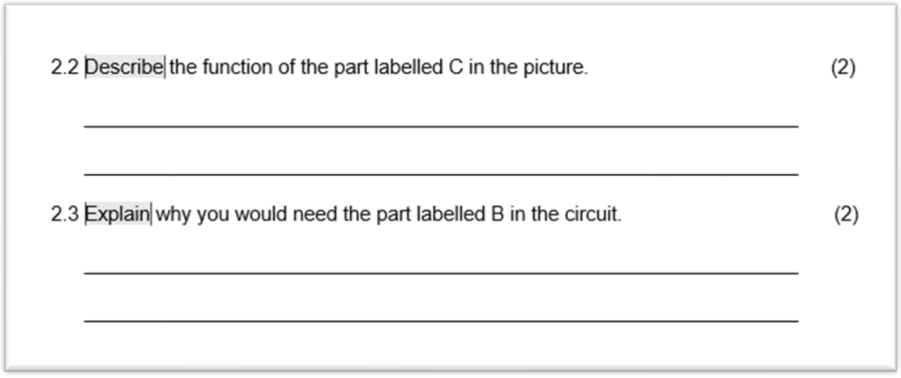
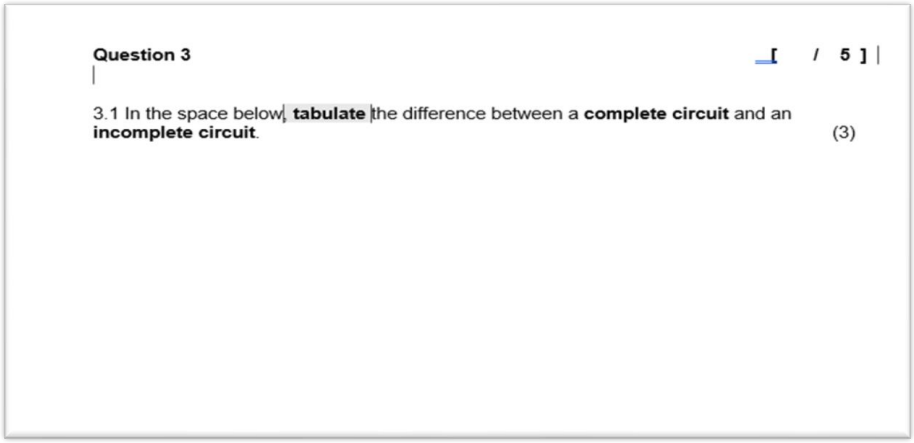


FIGURE 8: QUESTION 2.2 & 2.3 FROM THE WRITTEN ASSESSMENT

should be familiar with these terms. However, learners interpretations of ‘explain’ and ‘why’ show that learners are using different task words interchangeably or they use the task word asked to explain the task word. This shows that learners do understand the meaning of ‘define’, “describe’, ‘explain’ and ‘why’.

4.4.8 Association of task word

For the task word ‘tabulate’ learners were unsure and were saying what came to mind. Their responses centred around “to draw”, however, they did not allude to a drawing table but rather the differences of a complete circuit and incomplete circuit. This result shows that for question 3.1 as seen in Figure 9, may have associated tabulate with drawing as the saw there was a space provided for them to draw.


Question 3 [/ 5]

3.1 In the space below, **tabulate** the difference between a **complete circuit** and an **incomplete circuit**. (3)

FIGURE 9: QUESTION 3.1 IN THE WRITTEN ASSESSMENT.

4.4.9 Explanation of task words by teachers

These results indicate that learners do not understand majority of the task words asked in assessment question which is why I explored how these task words were explained to learners. The focus group participants were asked whether these task words were explained to them, and all learners exclaimed that all the task words were explained except for 'tabulate'. The learners mentioned that these task words were explained by their English teachers "Mrs X and Mrs K" and their Natural Science and Technology teacher "Ms Soloman". Learners were then asked how these words were explained to them and the learners mentioned that "She would explain the task words using her own understanding from the textbook." Another learner went on to say, "She would make use of examples to make the definition of the task word clearer for us."

This finding points to the importance of the way educators teach especially task words. Although learners have been reading and using task words, they do not understand what instruction the task word is expecting from them. Teachers have taught the task words. However, learners did not make meaning of the task words even though the teaching strategy may have been easier to explain to learners, it seems that truly little understanding was obtained. Therefore, significance needs to be placed on educators teaching learners the meaning of task words and ensuring that they fully understand what is expected of them when the task word is used as supported by Gul et al. (2020).

4.4.10 Intended meaning of subject terminologies.

As previously mentioned for the ease of the study I will explore the intended meanings of the subject terminologies first before exploring learners interpretations.

Figure 10 shows the percentage of focus group learners who incorrectly interpreted the subject terminology.

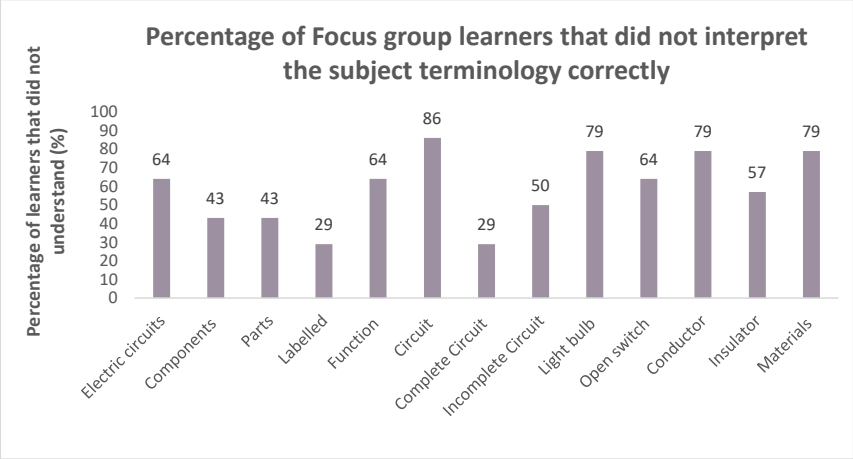


FIGURE 10: PERCENTAGE OF LEARNERS FROM THE FOCUS GROUP DISCUSSIONS WHOSE INTERPRETATION OF THE SUBJECT TERMINOLOGY WERE INCORRECT (N=14).

4.4.11 Correct interpretations of subject terminologies

The following subject terminologies were correctly interpreted: 'components', 'parts', 'labelled', 'complete circuit' and 'incomplete circuit'. 'Components' are "parts of an electric circuit" (Adatia, et al., 2013, p. 118). 'Parts' are a "component or piece of something" (Southern African Concise Oxford Dictionary, 2009, p. 848). Figure 10 shows that only 43% of learners incorrectly understood what 'components' and 'parts' meant. 'Labelled' means to "attach a label or name to something" (Southern African Concise Oxford Dictionary, 2009, p. 645) 'Complete circuit' is an "unbroken pathway where there can be no gaps between the parts of an electric circuit" (Adatia, et al., 2013, p. 118). . Only 29% of learners misinterpreted 'labelled' and 'conductor' according to Figure 10. 'Incomplete circuit' is a "broken pathway where there are gaps in the circuit" (Adatia, et al., 2013, p. 118) which 50% of the learners misunderstood. The percentage of learners who incorrectly interpreted these terminologies range from 29 % to 50% showing that majority of the learners understood the subject terminologies.

4.4.12 Incorrect interpretations of subject terminologies

Learners misinterpreted the following subject terminology: 'electric circuit', 'function', 'circuit', 'light bulb', 'open switch', 'conductor', 'insulator' and 'materials'. 'Electric circuit' is defined as "a system for transferring electrical energy from one place to another" (Adatia, et al., 2013, p. 118). 'Function' means "work or operate in a proper or particular way" (Southern African Concise Oxford Dictionary, 2009, p. 466). 'Circuit' means "a system of electrical conductors and components forming a complete path around which an electric current can flow (Southern African Concise Oxford Dictionary, 2009, p. 209). A 'light bulb' "converts or changes electrical energy into light energy" (Adatia, et al., 2013, p. 116). A switch is "a component for controlling whether current flows in an electric circuit" (Adatia, et al., 2013, p. 118). An 'open switch' "stops current flowing in an electric circuit" (Adatia, et al., 2013, p. 118). 'Conductor is "a material that allows electrical current to flow through it" (Adatia, et al., 2013, p. 118). An 'insulator' is "a material through which an electrical current is not able to travel through (Adatia, et al., 2013, p. 118.). 'Materials' are "items needed for an activity" (Southern African Concise Oxford Dictionary, 2009, p. 717). The percentage of learners who interpreted these words incorrectly range from 57% to 86%. Therefore, it is vital to gain insight on how learners were taught these subject terminologies.

4.4.13 Learners interpretation of subject terminology

Now, I will present learners' interpretation of the subject terminology used in NST assessments. It is important to note that participant 4 from focus group one was present for this interview. Therefore, the total number of learners responses was 14 learners.

4.4.14 Correct interpretations

Subject terminology such as 'components', 'parts', 'labelled', 'complete circuit' and 'incomplete circuit' were interpreted correctly. Learners interpreted 'components' as "parts of an electric circuit". 'Parts' was understood to be "the different components or objects of an electric circuit". 'Labelled' was interpreted as "to give a name to something". 'Complete circuit' was 'a circuit with no missing components" or "no missing gaps" and 'incomplete circuit' was interpreted as "circuit with missing components" or "has gaps". These interpretations show that when learners are confident with the subject terminology, they are more willing to express themselves and explain the concept in their own words. I also think that the way the content is taught has an impact on the way learners interpret the subject terminology.

4.4.15 Explanation of the root word

When looking at the subject terminology 'electric circuit' only 5 out of 14 learners interpreted 'electric circuit' correctly as a "system which transfers electrical energy with electrical components". 9 out of 14 learners could not define 'electric circuit' in question 1.1 (see APPENDIX D). Whereas when they interpreted 'circuit' learners' responses varied from "the whole thing of an electric circuit combined" to "one part connected to the next". This finding is important because it explains why learners struggled to explain what an electric circuit was as they did of understand the basics of an electric circuit.

In question 4.1.1, a 'conductor' was interpreted as "something that conducts or produces electricity." This finding shows that learners are using the word to explain the word. As teachers when teaching subject terminology, we need to be careful as to our choice of words ensuring that we are explaining the meaning of the terminology by breaking it down to the simplest form and not repeating the word to explain the word. When repetition of the word occurs, this is indicative that understanding was not achieved. Common misconceptions also came up whereby learners thought a conductor produces electricity or amplifies the power.

Therefore, it is important when teaching is occurring for teachers to explain the root word or foundation of subject terminologies as well. They should break down the word into simple parts for learners to gain a deeper understanding of the subject terminology and to initiate the process of learners constructing knowledge for themselves.

4.4.16 Neglect of tapping into prior knowledge

Learners understood the word 'function' to mean "how an object or something works" or "something that works properly". 'Light bulb' was interpreted as "lights up when there's electricity" or "light you can switch on that is electrical" and "object that produces light energy". This question expected learners to explain what a simple object, a 'light bulb' was, however, learners had difficulty interpreting this. The results show that learners' related the answer back to lighting up a place meaning that majority of them did not recall that 'light bulbs' were taught to them as far as grade 4, whereby they learnt about the several types of energy and energy conversions (Department of Basic Education, 2011). In terms of 'function', 'function' is used often in NST assessments since grade 4, however learners failed to correctly interpret 'function'. This may be a potential to explore whether teachers are tapping into learners' prior knowledge as learners may be constructing knowledge on existing knowledge that may be incorrect (Jones & Brader-Araje, 2002). Therefore, this finding shows that it is

important for teachers to teach and ensure that learners know the correct definition of words. Tapping into learner prior knowledge will assist in showing learners explicitly how the concepts taught are connected.

4.4.17 Different meaning of words

An ‘open switch’ was interpreted as “something that stops the flow of energy” or “short switch which transfers energy” or “when the circuit is on”. Although some learners understood what an open switch was, many learners confused the open switch with the function of a closed switch. This finding points to subject terminology used in NST. Often words will have a particular meaning in colloquial English which is known as Basics Interpersonal Communication Skills (BICS) (Cummins, 2008) , however, in NST the meaning is opposite to what learners are used to as seen with an open switch. This may be an abstract idea to build on in learners minds as they are familiar with colloquial English. Therefore, when it comes to subject terminologies both teachers and learners must work together to ensure that the correct meaning is learnt for learners to have a better understanding of the content and to be able to explain it in the correct way.

4.4.18 Dependency of subject terminology on task word vice versa

When looking at the subject terminology ‘complete circuit’ and ‘incomplete circuit’, it is important to note that although learners had a good understanding of these terminologies, they could not adequately answer question 3.1 as they did not know how to ‘tabulate’. Their lack of understanding of the task word hindered them.

In question 4, learners struggled to interpreted terminologies such as ‘conductor’ as previously mentioned, ‘insulator’ and ‘materials. Learners interpreted ‘insulator’ as “materials that does not allow electricity through”. Some of these learners made use of examples to explain the word. Importantly when we assess we do not necessarily allow learners to explain using examples, however, when we teach, we explain using examples. This may disadvantage learners as there is a misalignment with the way we teach and assess. I personally like the use of examples as it is indicative that a learner has understood the terminology and is trying to explain it in their own words.

‘Materials’ was interpreted as “things that are used to make something” or “objects or things”. Learners struggled to express their interpretation of ‘materials’. This is an important finding because throughout NST, learners are conducting practical tasks and investigations which require them to list the materials needed for their investigation. Therefore, if they cannot define

what a material is they are going to struggle in high school whereby they are introduced to apparatus which they will need to manipulate to carry out the investigation or experiment.

Learners' lack of understanding the subject terminologies 'conductor', 'insulator' and 'materials' prevented them from answering question 4 sufficiently. Learners understood the task words 'compare' and 'suggest' which are higher cognitive level questions, however, their misinterpretation of the subject terminology resulted in them not passing the question. Therefore, these findings point to the dependency of subject terminologies on task words and the dependency of task words on subject terminologies.

4.4.19 Explanation of subject terminology

When learners were asked if they were taught the subject terminology and they all said yes. Learners responded that they were taught these words by their NST teacher. She taught them by making them write out the key word then she would explain the word without using the textbook. She would explain the word in her own understanding and the break down the word into simple terms especially scientific terms. She would make use of practical examples to show learners what she meant. A learner mentioned that "She would use simple words to explain the subject terminology." This is an important finding because it shows that sometimes when we teach subject terminology, we tend to simplify the word for learners to understand however, when we assess them, we expect the textbook definition and may mark a learner wrong even if their understanding was correct. In my school, as NST teachers we do that. Therefore, there is a misalignment between the way we teach and assess. Many times, when we know a learner has dealt with a word like 'materials' before, we neglect to re-explain the work as we assume the learner already has a correct understanding of the word which may be incorrect. As teachers, we need to ensure we are tapping into prior knowledge.

4.5 Learners approach to assessment questions

After the assessments were scored and the discussions were concluded, I wondered about how learners approach assessment questions; although, they may not understand what the task word or the subject terminology may mean, they must be approaching the question in a particular way. I, therefore, took focus group 1 for an additional discussion which I conducted in which I explored this further. I chose this group as they were the group who scored the highest meaning that they possibly understood the assessment questions, the task words, and the subject terminology the best. However, when the discussions on the task words and subject terminology were conducted, the results showed that even these learners did not have a good

understanding of the task words, even though they scored the highest in the written test. Therefore, I asked these 4 learners questions based on their approach to assessment questions as mentioned in Chapter 3 which was conducted after all 4 focus group discussions were conducted.

When learners approach to assessment questions was probed further, 2 out of the 4 learners mentioned that if the question was long, they would skim over the question and look for the main points as seen below in Figure 11.

Two out of 4 learners said that they read the entire question and answer part by part. This

Ms S: When you look at a question on a test paper and if the question is long, do you read the entire question? How do you approach the question?

Luke: I look at the question to where it wants me there to the main points. I look for the main points and take that point and say to myself so this is what I have to do so I have to write this.

Ms S: So, do you read the entire question?

Luke: No.

FIGURE 11: PARTICIPANT 3 FROM FOCUS GROUP 1'S RESPONSE TO HIS APPROACH TO ASSESSMENT QUESTIONS.

finding is a concern as these learners are only in grade 6 and they do not read the entire question or information before they answer a question. By not reading the entire question, I believe learners may not gain information related to the question which may be beneficial to them which may result in them not understanding the question in its entirety. It is surprising to find that they are not reading fully, especially since they indicated they read a couple of pages in a book every day, apart from reading for school purposes.

Learners were also asked about sentence construction. Learners mentioned that a sentence is made of a subject, verb and a noun or object. They added that a sentence needs tense and words. I went on to explain that a sentence has a main idea and a less important idea. All 4 learners agreed, and one learner mentioned that that is why he looks for the main ideas only. The less important ideas were ‘useless information to him’, and he did not want to work with the information that is not important as seen below in Figure 12.

Ms S: Yes, a noun. Now if we look at the sentence it has the subject or the noun then the verb and then the object, whether the sentence is long or short, the sentence will always have two ideas. The main idea and the less important idea, right?

All learners: Yes.

Ms S: That what you do Luke, you look for the main idea right.

Luke: Yes, I don't want the useless information.

Ms S: So, the less important ideas are the useless information.

Luke: The ones that are not important.

FIGURE 12: PARTICIPANT 3'S RESPONSE TO MAIN IDEAS AND LESS IMPORTANT IDEAS OF A SENTENCE.

This finding is significant because the learner is mentioning that he would rather focus on the main idea which will provide him with more information pertaining to the question. Ignoring other pertinent information such as task words, the process.

4.5.1 Intervention strategy

During the additional focus group discussion, I went through an intervention strategy whereby I asked learners to find the verb and the noun in each question as mentioned in Chapter 3. All 4 learners were able to complete this task successfully. Through this process, learners were able to see the importance of finding a verb and a noun in an assessment question. They saw that if they do not identify the verb and the noun, they can easily misinterpret the question. Learners were then asked to rephrase the question to each other. By finding the verb and the noun learners admitted that the found it easier to re-phrase and understand the assessment questions.

Three of the 4 learners mentioned that it would benefit grade 6's if all learners were taught to identify the verb and the noun in an assessment question. One learner mentioned that he did not think that learners need to learn how to identify the verb and the noun in a question as they have been learning about verbs and nouns in sentences for a long time and he questioned why they had to learn it again. Another learner mention that she thought teachers should teach learners how to identify the verb and noun in assessment questions as learners only identify verbs and nouns in English. She added that learners only see assessment questions as words, they do not identify the words as verbs and the nouns as seen in Figure 13 below.

This is a particular important finding to this study in my observation, learners never approach an assessment question identifying the verb (which is the task word) and the noun (generally

the subject terminology). They read the questions as words and not deconstruct the sentence to make meaning of it. If the NST and English teachers collaborated and assisted each other in helping learners make these identifications, along with being taught the meaning of task words and the subject terminology, learners would understand what is expected of them from assessment questions. This may also aid learners in making meaning of what the task word and subject terminology means.

> Ms S: I like that answer because it means the other learners don't understand then what a verb and a noun is and they have been learning it for years.
>
> Annie: I would say you should do it because they are mainly used to it when they do English. So, in Natural Science and Technology yes sentences have verbs and nouns, but they will not use them because they will just see them as words.

FIGURE 13: PARTICIPANT 4'S RESPONSE TO THE BENEFIT OF TEACHING LEARNERS TO FIND THE VERB AND THE NOUN IN ASSESSMENT QUESTIONS.

4.6 Conclusion

The main research findings of Chapter 4 showed that learners do not have a good conceptual understanding of the task words (Bloom's taxonomy) and the subject terminology used in Natural Science and Technology formative assessments. Learners depend on their understanding of the task word if they fail to understand the subject terminology, or they depend on their understanding of the subject terminology if they do not understand the task word. If learners do not understand the meaning of both the task word and the subject terminology, they unsurprisingly tend to answer the assessment question inadequately. Learners may also use another task word or the task word itself to interpret the task word. The same was seen for subject terminologies. When it came to subject terminologies learners did not have a proper understanding of the root word. This indicated that there was a possible neglect surfacing prior learners' prior knowledge which may have resulted in inaccuracies of their explanation of subject terminologies. Leaners also struggled to separate the meanings of NST terminology with the meaning of colloquial English words. All these findings point a difficulty that may lie in the way that task words and subject terminologies are explained by teachers. In addition, learners do not know how to approach and deconstruct an assessment question which will be beneficial if taught to learners. These findings will be discussed in more detail in Chapter 5.

Chapter 5: Discussions, Recommendations, and Conclusions

5.0 Introduction

The purpose of this study was to investigate Grade 6 learners' conceptual understanding of the task words and subject terminology in Natural Science and Technology formative assessments. In this chapter, I discuss learners' conceptual understanding of the task words and subject terminology used. In this respect, this chapter will provide a discussion of the results, the implications of the study, the limitations of the results and the recommendations of this study. The main research question that guided this study, and against which the results are discussed was:

What is grade 6 learners' understanding of task words (used in Bloom's taxonomy) and subject terminology in Natural Science and Technology formative assessments?

The sub- questions that this study aimed to answer were:

1. What are the task words and subject terminology that are used in grade 6 learners' Natural Science and Technology formative assessments?
2. How do grade 6 learners interpret assessment task words (Bloom's) and subject terminology used in Natural Science and Technology formative assessments?
3. How do learners' interpretations of task words and subject terminology compare with its intended meaning?

5.1 Discussion of the results

The results discussed in Chapter 4 indicated that 30 out of 101 learners failed the written assessment. However, the average score for the test was 47%. This is a low average meaning that majority of learners obtained a level 3 according to CAPS for the test indicating that the have performed adequately (Department of Basic Education, 2011). Thereafter, 14 learners participated in the focus group discussions which revealed that these learners do not have a good understanding of the task words and the subject terminology used in the NST assessment. The findings discussed next appear to indicate a problem in the way teachers explain task words and subject terminologies.

5.1.1 Key finding 1: Learners' interpretations depended on their of understanding of task word or subject terminology.

As seen in Chapter 4, it was evident in this study that a high percentage of learners did not interpret the task word and subject terminology correctly. Throughout the study on various occasions, a pattern arose whereby when participants were asked what their understanding of

a certain task word such as ‘compare’ and ‘suggest’ was, learners interpreted the task words correctly despite the increase in cognitive demand. However, they answered the assessment question incorrectly indicating that they did not understand the meaning of the subject terminology. A similar pattern occurred whereby learners did not understand what the task word ‘state’ meant however, because they understood what the subject terminology ‘components’ meant, they were able to answer the assessment question correctly. These findings show that learners are interchangeably making meaning of the assessment question by drawing understanding on their correct interpretation of the task word or the subject terminology. Learners used different parts of the question to infer what was being asked of them.

Their conceptual understanding of the task words and subject terminology was, therefore, poor. Conceptual understanding is determined using assessments (Chang et al., 2010), however it has been found that learners may memorize information and not fully understand the meaning of concepts (Konicek-Moran & Keeley, 2015). This means that learners have not engaged with the task words and subject terminology to develop this vocabulary intellectually (Konicek-Moran & Keeley, 2015). Importantly learners need to have a good understanding of both the task word and subject terminology to make meaning of the assessment question. Task words and subject terminology are vocabulary that should be taught to learners thoroughly. However, even I as a teacher tend to not pay much attention to how well learners understand these words or even assess them on such vocabulary which may be the downfall to learners’ inadequacies in assessment.

A study conducted by Buly and Valencia (2002) showed that middle school students (equivalent to grade 7 to 9 in South Africa) struggled with vocabulary assessments (Buly & Valencia, 2002). The findings showed that students who spoke English as their second language found it more challenging to retain vocabulary, however the unique circumstance of each learner affects them differently (Buly & Valencia, 2002; Laufer & Rozovski-Roitblat, 2015). The issue of second language speakers in English medium schools is an important one that has emerged and may be worth investigating further. However, it is not within the scope of this project to do so.

In addition to possible language issues, learners who were taught the definitions of the words performed better on the assessments. Laufer and Rozovski-Roitblat (2015) showed that learners who had a dictionary to assist them performed better on assessments (Laufer &

Rozovski-Roitblat, 2015). Although learners in this present study were exposed to both the task words in English from previous grades and subject terminology which was explained to them in their NST lessons, learners struggle to make meaning of the both the task words and subject terminology. I now realise that I, as their NST teacher, neglected to tap into their knowledge of these terms as there is limited time to do so during lessons, and I took for granted that they would have learnt these words from the previous grade. Teachers need to place importance on tapping into learners' prior knowledge as one can never certain if certain fundamentals had been covered adequately in previous grades (or at all), and how knowledge was constructed (Jones & Brader-Araje, 2002). Therefore, despite time constraints of completing the Annual Teaching Plan (ATP), it would be beneficial if teachers took time to ensure that learners understood the meaning of the task words and subject terminology as this may increase learners understanding of assessment question and they will be able to comprehend what the question is asking of them as their interpretations of task words and subject terminology was insufficient.

5.1.2 Key finding 2: Learners' use of a word itself or another word to interpret the task word or subject terminology.

When analyzing how learners' interpretations of task words and subject terminology compared with its intended meaning, many learners used the task word itself to explain the task word. For example, when asked what they understood the task word 'explain' meant learners said, "means to explain something" or learners would use another task word to interpret one task word, for example 'define' means "to describe something". By making use of the word itself or using another task word to interpret a task word indicates that learners do not understand the meaning of the task word asked which led to them not answering the questions adequately. There was also an instance whereby learners associated 'tabulate' with drawing. Learners did not understand what tabulate meant, however because they saw a blank space was provided by the assessment question, learners assumed they needed to draw something which related to the subject terminology.

The subject terminology was understood by most learners, however some learners incorrectly interpreted certain terms such as 'conductor' was explained as "something that conducts or produces electricity". Again, learners are using the word to explain the word. Thus, repetition is observed indicating that understanding was not achieved. Learners also struggled to explain the root word of subject terminology such as 'circuit'.

Using the same task word or not understanding the root word of a subject terminology shows that learners may be misinterpreting vocabulary based on how these words were taught to them. The main issue here would be inadequate vocabulary, which can be attributed to low retention of information or inadequate teaching methods (Lawerence et al., 2010). Importantly, when analyzing the definitions of task words, within CAPS there is no explanation of what each task word means (Department of Basic Education, 2019). There is also no time allocated on the ATP for teachers to teach learners task words in depth. Learners thus progress from grade to grade with little conceptual understanding of these vocabulary words. To mitigate this, teachers need to go the extra mile and provide opportunities in their lessons whereby learners can interact with task words and subject terminologies instead of reciting the definitions. In addition, teachers, when teaching subject terminology, need to be careful with the choice of words used, and ensure that the meaning of the terminology is explained by breaking it down to the simplest form. Learners adapt to teaching methods, so if teachers do something, learners will want to do the same. Therefore, teachers need to allow learners to construct knowledge for themselves, in this context perhaps by getting students to explain things to each other, to gain a deeper understanding of words being taught and assessed.

5.1.3 Key finding 3: Teachers neglect to surface prior knowledge.

From a constructivist teaching perspective, a major aspect of teaching as a knowledge construction process is tapping into prior knowledge. In this study learners could not define what a ‘light bulb’ was or what ‘function’ means, even though they were taught this since grade 4. The assumption that this was covered for, therefore, not unrealistic and explains why a teacher may neglect delve in what understanding a learner has obtained from work taught 2 years prior (Department of Basic Education, 2011). However, the findings in this study show the importance of tapping into learner prior knowledge, as one does not know how knowledge was constructed in the past.

Knowledge is built on existing mental models that learners have formed through their experiences (Bada & Olusegun, 2015). As challenging as it is to break down learners existing knowledge, a teacher can change the way a learner thinks about certain concepts by tapping into that prior knowledge and correcting those misconceptions (Bada & Olusegun, 2015). If learners are promoted or progressed from grade to grade, a teacher will remain unaware of the misconceptions that a learner has grasped and continues to build knowledge upon. This will further prevent a learner from conceptually understanding vocabulary such as task words and

subject terminology where they may have incorrectly understood the word. This will greatly impact their performance in both formative and summative assessments.

5.1.4 Key finding 4: Learners rely on colloquial English to make meaning of words.

Tapping into prior knowledge will also assist teachers to explore the meaning words have for learners. Learners interpreted an 'open switch' with the function of a 'closed switch'. Subject terminology in NST tends to have a different meaning to colloquial English. Subject terminology is academic language that learners must read, write, and interact with to make meaning of content and lessons (McComas, 2013). Subject terminology relies highly on the language that is spoken and learnt. Understanding subject terminology becomes an issue as learners start to construct meaning of words through their daily interactions (Konicek-Moran & Keeley, 2015). Learners tend to focus on their Basic Interpersonal Communication Skills (BICS) as this is their means of interacting with people daily (Cummins, 2008). However, teachers in their lessons and assessments make use of cognitive academic language and may assume that students have adequate Cognitive Academic Language Proficiency (CALP). However, as demonstrated in this study, learners struggle to distinguish between BICS and CALP. Learners thus use words learnt from their everyday lives (BICS) as academic language (CALP), as also discussed by Cummins (2008).

Context is also important in knowledge construction. Learners come from different backgrounds, and they may be brought up speaking differently languages, meaning that English is probably a second or third language for them. When taught subject terminology, the scientific vocabulary is a fourth language for learners which further hinders them from exploring and developing CALP.

Subject terminology in NST is comprised of words that tend to be long and difficult to pronounce, preventing learners from reading the word correctly. The complexity of scientific vocabulary may therefore hinder the learning processing of learners (Härtig, 2014). Learners who speak English as their second language, also find it difficult to retain vocabulary (Buly & Valencia, 2002). If we observe our South African context where our learners speak more than one language, it makes sense why learners struggle to retain the meanings of task words and subject terminologies.

A qualitative study by Saifi and Mehmood (2011) also showed that socio-economic status can affect learners' abilities to retain information (Saifi & Mehmood, 2011). Therefore, being aware of students' backgrounds and language proficiency, and tapping into learner prior

knowledge is a crucial starting point as it will guide teachers in terms of the direction in which teaching, and construction of knowledge needs to take place, and the scaffolding required to assist learners.

The explicit development of CALP is also important especially since assessments are crafted on CALP. I believe it could be especially beneficial in NST for teachers to carry out practical tasks, and experiments in their classrooms, where CALP is woven into the experiential learning event, to aid learners in gaining a deeper understanding of the subject terminology used in NST. There also needs to be an ongoing iterative process of explaining and checking for understanding of terms, which will also help develop learners' CALP. Teachers also need to give learners an understanding of the task words and subject terminology as it will greatly assist them in assessments, and they should also pay attention to their choice of task words.

5.1.5 Key finding 5: Teachers' explanation of task words and subject terminologies used their own words and simplified terms.

Although this study focused on grade 6 learners, during the data collection process a finding emerged that when it came to the explanation of how teachers taught task words and subject terminologies, it was evident that teachers explained using examples and their own words and they would make use of simple words. This illustrates that teachers themselves move away from CALP to simplify explanations using BICS to enable students to grasp the concepts. However, this has unintended consequences. In the pursuit of aiming to assist learners in understanding concepts better, teachers decrease the value given to academic language, which may lead to a problem when it comes to assessments. During assessments, especially at the school in the present study, learners are expected to provide answers that are academically correct (with the use of scientific language). Although their understanding using everyday language may be correct if a learner does not use the correct vocabulary, they may be marked wrong in an assessment question or given half the marks. Learners are thus disadvantaged, as teachers are teaching using everyday language, however, we assess learners using academic language in assessment questions. A way around this might be for teachers to follow up the explanations in BICS with a summing up that integrates the BICS and CALP.

5.1.6 Sub-finding 1: Learners lack knowledge on how to approach assessment questions.

According to CAPS, teachers construct assessments at a grade 6 standard with the assessment questions being composed of 50% lower order questions, 35% middle order questions and 15%

higher order questions (Department of Basic Education, 2011), based on the level of cognition in Bloom's Taxonomy (Anderson & Krathwohl, 2001). However, as previously mentioned, the amended CAPS document for NST does not provide teachers with definitions of each task word used in Bloom's taxonomy (Department of Basic Education, 2019). This could be why NST teachers tend to leave the explanation of task words out of their lessons, as they may be uncertain of the meanings themselves. The repercussion is that learners are then progressed to the next grade with an incorrect or incomplete understanding of the task words. It is also possible that learners might encounter the definitions of the task words in the previous grades from English teachers, but this is usually done within the context of a particular topic in English, once off. Learners therefore need to be continually reminded of the explanations of the task words as they move from grade to grade, and perhaps also subject to subject, to ensure that learners are understanding what is expected of them from assessment questions.

In summary, this study showed that learners may not know how to approach an assessment question. If the assessment question is relatively long, learners skim over the question, not reading the entire sentences and therefore missing some information in the question being asked. This may be the result of learners not being taught to look at an assessment question as a sentence that can be deconstructed into a main idea and the less important idea, with a verb (task word) and a noun (subject terminology) (Fitri, 2017). When learners were taken through this process in a scaffolded manner, they found it easier to answer the assessment question.

Some learners may also read an assessment question just as words without processing the meaning. Learners are isolating what they learn to specific concepts or key words. Teachers, therefore, need to explicitly show learners how to connect concepts taught from English and how these are incorporated in NST. Therefore, for teachers it goes beyond teaching learners the meaning of words. Rather in addition to providing learners with understanding of task words and subject terminology, NST teachers in collaboration with English teachers need to show learners how to approach assessment questions, with explicit explanation of the task words. This will greatly assist learners in performing better in assessments and hopefully result in more learners pursuing careers in NST.

5.2 Implications

This study has implications for both teachers and learners. Teachers need to have a firm understanding of the task words and subject terminologies used in NST formative assessments. If they are unsure of the definitions especially of task words, they should collaborate with

English teachers to become familiar to assist learners with understanding the task words as well how to deconstruct an assessment question. Similarly, poor performance by learners in formative assessments may be a result of misinterpretation of the task words and subject terminology used. Poor performance may also be the result of not knowing how to deconstruct an assessment question or how to approach the assessment question and their lack of conceptual understanding of both the task words and subject terminology, which can also be addressed through greater engagement and collaboration between English teachers and teachers of other subjects, to reinforce the meaning of task words across different subjects.

Teachers should also pay close attention to tapping into learners' prior knowledge, as this will assist in guiding their lesson in the correct direction. It may also enable teachers to address misconceptions that may have been constructed in learners' minds throughout the years.

However, teaching must go beyond transmitting content. Teachers need to take time to understand their learners and the backgrounds that they come from as this will allow teachers to better support their learners. By understanding learners' circumstances better, teachers will know if they are dealing with learners with potential challenges related to language or their socio-economic status and will be able to support learners in more targeted ways. Being wary of their choice of words and language used during teaching and learning is also vital, as is making learners aware of the distinction between an explanation in everyday language versus explaining concepts using scientific terminology (as is expected in assessments) may also improve learners' understanding and performance in tests. Teachers should also foster a comfortable environment whereby learners can feel safe to respond and be open with the teacher when answering questions.

5.3 Limitations

The limitations to this study were the small sample size and time constraints significant. The school is a small school with only 3 classes of grade 6 learners, limiting the population size to 101 learners. Furthermore, the number of participants in the focus group discussions was reduced to 14 learners compared to the 16 I had initially chosen, due to unforeseen circumstances with 2 of the learners. Time and lack of parental consent from most learners also prevented me from selecting more learners. These limitations prevented me from using a larger sample size. It would also be beneficial if this study was conducted on a larger scale such as grade 6's from more schools in the area and if attention was paid to the backgrounds and

contexts learners come from such as learner's home language and whether English is their first or second additional language.

5.4 Recommendations

The study found that learners do not conceptually understand task words and subject terminolgy used in NST formative assessments. This can be mitigated if teachers tapped into learner prior knowledge and took time to ensure learners understood the meanings of such vocabulary. My recommendation is that teachers should be selective in, and aware of their language patterns during teaching and learning, making sure that scientific terminology is explicitly integrated into explanations. Also, if the NST and English teachers collobrated and assisted each other in heping learners to identity certain vocabulary, along with explicitly teaching the meanings of task words and the subject terminology, learners would understand what is expected of them from assessment questions. This may also aid learners in making meaning of the task word and subject terminology. .

Based on the findings, I would like to develop a program or some sort of professional learning event where these results are discussed and teachers can be equipped with further skills and knowledge to help learners understand task words and subject terminology as well as to enhance learners understanding of assessment questions. This could potentially greatly influence learners' performance, The department of education could also draw on the findings of this research to draft a document which addresses the defintions of task words to supoort teachers during teaching and learning.

5.5 Conclusion

As an NST teacher it concerned me that my learners were not performing adequeately in assessments. This study demonstrated that the reason for the poor performance of grade 6 learners in the topic of electric circuits may lie in learners not understanding the task words and subject terminology used in formative assessments. While the findings were specific to the topic of electric circuits, it is very likely similar across the other NST topics, although this would need to be verified. Another challenge is the the use of BICS by teachers in their explanations through the use of colloqiual English, while assessments are structured in CALP. Learners therefore may not be able to bridge the gaps and may not know how to approach an assessment question and make meaning of what is being asked of them. Therefore, it is recommended that teachers ensure that they use CALP in conjunction with BICS to explain concepts. It is also important for teachers to take time to throughly tap into learner prior

knowledge to determine if learners know the foundational concepts before elaborating by adding new terms. Lastly, through collaboration with English teachers, NST teachers need to teach learners how to identify task words and to deconstruct assessment question. These will greatly benefit learners to perform to the best of their ability and will allow them to interpret questions better and to construct knowledge for themselves that they can still implement even at higher levels of study.

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APPENDICES

APPENDIX A: Written Natural Science Assessment

Westside Primary School

Natural Sciences and Technology

Grade 6

Written Class Test: Topic 10 – Electric Circuits

Question	1	2	3	4	Total	%	Rating Score
Mark Allocation:	4	6	5	5	**20**	**100**	**1-7**
Marks obtained:							

Instructions

1. Answer all the questions on the question paper.
2. Use a pen for writing.

Question 1 **[/ 4]**

1.1 Define the term 'electric circuit' (1)

_____

_____

1.2 State 3 components of an electric circuit: (3)

_____

Commented [BS1]: I have classified each question according to the Bloom's Taxonomy levels by selecting specific task words.

Each question has been allocated certain marks to meet the percentage of cognitive demands.

Commented [BS2]: Level 1 & 2 = 50% of the paper Lower order questions

Commented [BS3]: Level 3 & 4 = 35% of the paper Middle order questions

Commented [BS4]: Level 5 = 15% of the paper Higher order questions

Commented [BS5]: Level 1: Remembering – to recall or memorise basic facts

Commented [BS6]: Level 1: Remembering

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_____

_____

Question 2 **[/ 6]**

Analyse the diagram of a simple electric circuit below.

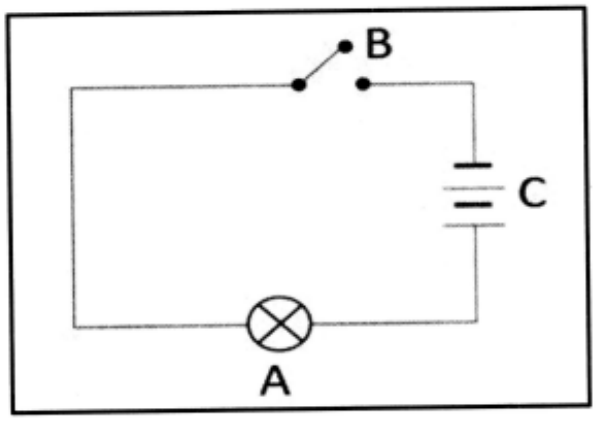


FIGURE 14: A SIMPLE ELECTRIC CIRCUIT

2.1 Identify the following parts in the picture labelled: (2)

Commented [BS7]: Level 2: Understanding

A - _____

B - _____

2.2 Describe the function of the part labelled C in the picture.
(2)

Commented [BS8]: Level 2: Understanding

_____

_____

2.3 Explain why you would need the part labelled B in the circuit. (2)

Commented [BS9]: Level 2: Understanding – to explain concepts

_____

_____

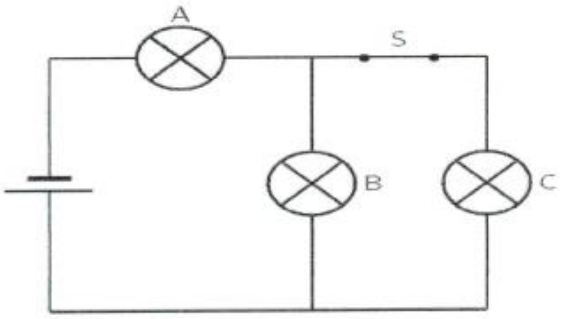
Question 3 **[/ 5]**

3.1 In the space below, **tabulate** the difference between a **complete circuit** and an **incomplete circuit**. (3)

Commented [BS10]: Level 1: Remembering how to tabulate
Level 3: Applying

Commented [BS11]: Level 1: Remembering how to tabulate

3.2 Study the diagram below.



3.2.1 Predict what would happen to the light bulbs if you added another open switch.

Commented [BS12]: Level 4: Analysing - Make connections amongst concepts and ideas taught

_____ (1)

3.2.2 Why do you think this happens?

Commented [BS13]: Level 3 & 4: Apply & Analysing

_____

_____ (1)

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Question 4 **[/ 5]**

4.1 Compare the difference between a conductor and an insulator in the table below. (2)

Commented [BS14]: Level 3: Applying - To use existing knowledge and apply it to new situations

Conductor	Insulator
4.1.1	4.1.2

4.2 Would you say it is important to know which materials are conductors and which materials are insulators? Suggest a reason to support your answer. (3)

Commented [BS15]: Level 5: Evaluating - To justify or argue a decision made

_____

_____

_____

APPENDIX B: Interview Schedule

An investigation of Grade 6 learners' conceptual understanding of task words and subject terminology in Natural Science and Technology formative assessments

Keeping in mind that learners who are being interviewed are those who have been selected for each focus group based on scores obtained in their assessments, the purpose of the interview is to obtain data on their understanding of the task words and subject terminology asked in the assessments.

Each learner may have understood or misunderstood certain task words or subject terminology in a question differently to other learners. Therefore, the semi-structured interview that will be facilitated in focus groups will be directed by the following probing questions and learners' responses to these questions that will guide the researcher on what questions to ask. The questions will be informed from the trends analysed from the written class test. However, the questions will have the following direction.

Interview schedule questions:

1) With the use of showing learners each question, ask learners,
   What do you think the word "explain" (ask the specific task word used in the question for example, explain, tabulate, describe etc.) means?
2) Why do you think this task word means that?
   Repeat question 1 & 2 for each task word used in the written assessment.
3) Were any of these task words explained to? By whom?
4) How were they explained?

5) With the use of showing learners each question, ask learners,
   What do you think the word "electric circuit" (ask the specific subject terminology used in the question for example, components, open switch, conductor, etc.) means?
6) Why do you think this key word means that?
   Repeat question 3 & 4 for each subject terminology used in the written assessment.
7) Were any of these subject terminologies explained to you? By whom?
8) How were they explained to you?

Use your discretion to facilitate questions asked to prompt learners to verbalise their understanding of each task word and subject terminology used.

APPENDIX C: Coding

Table showing learners' direct interpretation of the task word 'State'.

Questions	Question				
1.2	**What is the meaning of state?**	**Participant 1**	**Participant 2**	**Participant 3**	**Participant 4**
	Group 1	To name a type of term or object.	I would say it is to say.	State is to label.	
	Group 2		It's a word to say give the components.	When you state is when you label the things.	
	Group 3		It's when you know something.		
	Group 4			To 'state' is to give the name of something.	To 'state' is to list something.

Inductive analysis done through coding.

Coding for task word 'State'		
Colour	**Code**	**Theme**
	Name	Provide the name of something
	Label	
	List	Write below one another
	Say	Tell the meaning or understanding of something
	Know	

Appendix D: Task words in CAPS Amendments

4.1.2 Cognitive levels for the assessment in Grades 4, 5 and 6

Low order questions 50%		Middle order questions 35%		High order questions 15%	
Level Remembering	**Level 2 Understanding**	**Level 3 Applying**	**Level 4 Analysing**	**Level 5 Evaluating**	**Level 6 Creating**
Exhibit memory of previously learned material by recalling facts, terms, basic concepts, and answers.	*Demonstrate understanding of facts and ideas by organizing, comparing, translating, interpreting, giving descriptions, and stating main ideas.*	*Solve problems to new situations by applying acquired knowledge, facts, techniques and rules in a different way.*	*Examine and break information into parts by identifying motives or causes. Make inferences and find evidence to support generalizations.*	*Present and defend opinions by making judgments about information, validity of ideas, or quality of work based on a set of criteria.*	*Compile information together in a different way by combining elements in a new pattern or proposing alternative solutions.*
acquire categorise choose copy define describe find identify label list locate match memorise name omit point out quote recall recite recognise record relate repeat respond	classify compare conclude contrast define demonstrate describe differentiate discuss distinguish draw estimate exemplify explain express extend identify illustrate infer interpret locate match outline paraphrase	apply build calculate carry out change choose compute construct demonstrate develop dramatise employ execute exhibit experiment with identify illustrate implement interpret interview make use of model modify operate	analyse assume attribute break down calculate categorise classify compare conclude contrast correlate criticise deconstruct deduce detect devise differentiate discover discriminate dissect distinguish divide examine experiment	appraise argue arrange assess choose compose conclude construct criticise critique decide deduct defend derive design detect determine develop disprove document estimate evaluate experiment explain	adapt appraise argue assess build change choose combine compare compile compose conclude consider construct create criticise decide deduce design develop devise elaborate estimate evaluate
retrieve select show state tabulate tell trace	recognise relate rephrase report represent restate review show summarise translate	organise plan practice predict relate restructure select sketch solve	find infer inspect integrate investigate motivate organise outline probe scrutinise separate simplify structure survey test for	formulate generalise hypothesise interpret judge justify measure modify order organise predict prioritise produce propose prove rank rate recommend relate select test	formulate generalise hypothesise imagine improve infer integrate invent judge measure modify plan predict produce propose rate rearrange solve suppose test validate

Adapted from: Anderson, L. W., & Krathwohl, D. R. (2001). A taxonomy for learning, teaching, and assessing, Abridged Edition. Boston, MA: Allyn and Bacon.

APPENDIX E: Revised ATP 2021

Term 3 52 days	Week 1	Week 2	Week 3	Week 4	Wee
CAPS Topic	**Electric circuits** (2½ weeks)		**Electrical conductors and insulators** (2 weeks)		
Core Concepts, Skills and Values	• A simple circuit • Circuit diagrams		• Conductors • Insulators		
Requisite Pre-Knowledge	• Grade 5: Energy and electricity				
Resources (other than textbook) **to enhance learning**	• Laboratory Equipment: cells/batteries, conducting wires, light bulbs and switches • Supplementary Material: Video clips, YouTube videos, Phet Simulation, Pictures.		• Laboratory Equipment: cells/batteries, conducting wires, light bulbs and switches • Different materials including metal paper clips, nails, wire, steel-wool, coins, plastic, glass, ceramic, cardboard, paper, wood, rubber, chalk, plastic insulated wires, rubber gloves used by electricians, glass and ceramic • Supplementary Material: Video clips, YouTube videos, Phet Simulations		
Informal Assessment	• Investigate different ways of making a simple circuit • Investigate how a switch works • Design and make a switch to control the circuit. • Investigate bulbs by comparing torch light bulbs with a light bulb that are used in a light fitting in a house or in your classroom • Identify the six parts of a light bulb • Draw a circuit diagrams using various components (e.g.; 1 cell and 2 bulbs; 2 cells		• Investigate what conductors and insulators are. • Test different materials (such as metal paper clips, nails, wire, steel-wool, coins, plastic, glass, ceramic, cardboard, paper, wood, rubber, chalk) in an electric circuit to see if they are conductors or insulators, and recording the results in a table. • glass and ceramic insulators on power lines		
	and 2 bulbs; 3 cells and 3 bulbs; 3 cells, a bulb and an open switch; 1 cell, 2 bulbs and a closed switch (the switch must be in between the bulbs); etc.		• Design systems that use circuits to solve problems for people, whether it is the wiring in a house, an alarm bell, a lighthouse on the coast, or constructing toys, which use electrical energy to work.		
SBA (Formal Assessment)	• Practical Task/ Investigation • Test				