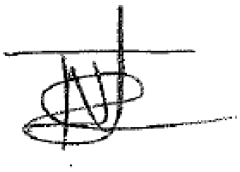
Declaration

I declare that this research report is my own unaided work with sources of the ideas or words used acknowledged. It is being submitted in partial fulfilment of the requirements in the education school of science for the Degree of Master of Science at the University of Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination in any other university.

I make this declaration on my honour as a postgraduate student at Wits University and recognise that by maintaining the declaration, I maintain both my own integrity and that of the University of which I am a member.



Judith Mukucha

14th day of May 2012 in Master of Science.

Epigraph

When learners of mathematics say they '**hate maths'** they mean to hate the mathematical terminology which they cannot readily get right and when they say they **'love maths'** they mean to love the mathematical terminology which they readily can get right. Therefore, it is on us teachers to give learners the 'Mathematical Wisdom' they need to understand the world by establishing, in class, the socio-mathematical norms which can rise terminology accessibility opportunities for every learner to every term so that all will learn to love mathematics, hence developing a mathematically informed South Africa. Because:

"Happy is the man who finds wisdom, and the man who gains understanding (Proverbs 3:13), for his proceeds are better than profits of silver and his gain than fine gold (Proverbs 3:14). Wisdom is the principal thing; therefore {let them} get wisdom. And in all {their} getting, {let them} get understanding (Proverbs 4:7)".

{...} self-edition

Abstract

Mathematics education studies have shown that part of learning mathematics is learning its language. The language of mathematics is said to include specialised terms and ordinary language terms that have contextual meanings in mathematics. Considering the fact that learners in South Africa are performing poorly in mathematics in the international comparative studies, e.g. TIMSS, there was a need to investigate how teachers facilitate second language learners' access to the meaning of mathematical terms in multilingual classrooms in South Africa. This study investigated a teacher's practices in the facilitation of learner access to mathematical terminology in a Grade 11 multilingual class in a township school in Vosloorus, South Africa. The study employed a qualitative approach in investigating Discourse practices that the teacher used to define mathematical terms to second language learners in a multilingual classroom. Direct classroom observations and a teacher interview were the main data gathering methods. The main findings were that the teacher used a combination of interactive practices that involved group work, telling, individual student interactions and initiation, response and evaluation methods. Among definition teaching strategies used were the *textbook procedural definition* and the *textbook descriptive definitions*. The chalkboard and the textbook were the main artefacts of the Definition Discourse. The study concludes that the Definition Discourse of the multilingual classroom is a process that involves not only the definition of terms but also an integration of teaching methods and interactive practices where definitions of mathematical terms can be taught even through the eliciting of procedural methods of working out mathematical problems.

Keywords: discourse; Discourse; Definition Discourse; mathematical terms; teacher practices; classroom Discourse,

Acknowledgements

In every success there are good and bad people behind it. The good people are those who wish you to finish successfully the **good thing** you would have started and the bad ones are those who wish you had not started. But both the people equally helped the doer of that good thing to get **the edge** because they both gave the doer all the confidence she needed to complete the started thing. I was confident in my good work and I endured till the ‘did was done’. For the bible says, “Being confident of this very thing, (Wisdom is the principal thing... (Proverbs 4:7)), that He who has begun a good work in... will complete it until the day of Jesus Christ” (Philippians 1:8).

Here I acknowledge the good people who were there to witness the success of this good ‘thing’, **the project**. The success of this research report was mainly made possible by **I,** the starter of the journey and my supervisor, **Dr. Clement Dlamini,** as the director. Dr. Dlamini has been a source of my inspiration, enthusiasm, imagination and dedication. He instilled in me the passion and direction which was needed in order to go through the demanding plans of this report. His kind-heartedness was firm but of an understanding personality when it comes to my failure to understand his directing arrows.

The second set of thanks goes to my co-supervisor, **Anthony Essien**, who helped me follow correctly my supervisor’s email directions about the project and gave me insights into how to better this report.

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My sincere gratitude goes to my family, especially my children Kundai, Danai and Takudzwa.

Finally, glory and honour be to God for the guidance and love He gave me through His Son Jesus Christ and with the lead and protection of the Holy Spirit, “For the Lord is good; His mercy is everlasting, and His truth endures to all generations” (Psalm 100:5).

Dedication

This report is dedicated to: Mr B. M. (late) and Mrs H. R. Mavhaya (parents), my family, Kundai, Danai and Takudzwa (sons) and Claver. Mukucha (husband).

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Chapter One

Introduction to the Study

1.1 Introduction

This chapter provides a background to the study focusing on how teachers explain mathematical terms in a multilingual classroom in South Africa. The chapter specifically presents the purpose, the aim, research questions and the objectives that guide the study. It also presents the problem statement and the rationale of the study which was conducted in a multilingual classroom in South Africa.

1.2 Problem Statement

Some research in the area of mathematics education has reported on difficulties learners encounter in understanding mathematical language in multilingual schools in South Africa (Setati, 2005; Kazima, 2008; Webb & Webb, 2008; Setati & Barwell, 2008). For example, findings of the research conducted by Setati and Barwell (2008) revealed that second language learners struggle in communicating mathematically. Communicating mathematically involves the skill of reading, speaking, writing and metalinguistic awareness which is the ability to reflect on and analyze a language. “Metalinguistic awareness enables the language user to reflect on the structural and functional features of the text as an object, to make choices about how to communicate information and to manipulate perceived units of language…” (MacGregor & Price, 1999, p.452). Learners should understand the mathematical terminology as they do mathematics so that they may not miss underlying mathematical concepts. According to MacGregor and Price (1999), learners should successfully uncover the messages of and about mathematics to show their understanding.

From my experience as a mathematics teacher, there is a general outcry that mathematics is a challenging subject and many teachers struggle to bring the mathematical understanding carried in the mathematical terminology to their learners, especially the second language learners. Many researchers have found that second language learners are not performing at the same level with English first language learners in mathematics (Bresser, Melanese, & Sphar, 2008). The most important aspect in learning mathematics in the classroom is communication. This encompasses how the teacher facilitates mathematical discourse among learners of different cultures, languages and ethnicity. Furthermore, in my experience as a mathematics teacher in South Africa, I have observed that teachers are not only faced with the challenge of planning well-designed instructional activities for learners to understand instruction, but also to ensure that learners understand the meaning of the words which are found in the language of mathematics and be able to express their grasp of the mathematical concepts. Hence, there is a need to establish how teachers in South African multilingual schools induct learners into mathematical terminology. It is on this basis that the study intended to investigate the 'pedagogic arrangements within which' and 'resources through which' defining mathematical terms related activities occur in the teaching of mathematics in South African mathematics classrooms.

1.3 Aim of the Study

The aim of this study was to understand how teachers facilitate access to the meaning of mathematical terminology by learners in multilingual classrooms in South Africa.

1.4 Purpose of Study

The purpose of this study was to investigate how teachers facilitate access to the meaning of mathematical terms (mathematical terminology) by learners for whom English is a second language in multilingual classrooms in South Africa.

1.5 Objectives of the Study

- Provide a better understanding of how teachers facilitate access to the meaning of mathematical terminology in multilingual classrooms in South Africa?

- Document a report on the role played by teachers in ensuring learners' understanding of mathematical terminology in multilingual classrooms in South Africa. This was carried out by studying one teacher in a classroom set up, teaching mathematics concepts through mathematical terms to the learners.

- Identify the key Discourse practices involved in the explanation process of the mathematical terminology.

1.6 Research Questions

1.6.1 Main research question

How do teachers facilitate learner access to the meaning of mathematical terminology in multilingual classrooms in South Africa?

1.6.2 Critical questions

1. How are the mathematical terms explained to learners in multilingual classrooms in South Africa?
2. What resources does the teacher use to explain mathematical terminology?
    a) Which languages does the teacher use to explain the mathematical terms?
    b) What artefacts being used to explain the terms?
3. What Discourse practices are involved in the explanation process of the mathematical terminology?

1.6.3 Justification for choosing the specific research questions above

The main research question was chosen to find out the practices that teachers undertake in explaining mathematical terms, while the critical questions were chosen in order to enable the researcher to answer the main question.

The first critical question was chosen to find out how the terms are made clear to the multilingual learners for them to understand. The second critical question was chosen to find out the resources that the teachers use when explaining the terms and the third critical question was chosen in order to find out the discourse practices that the teachers use to explain the terms. In answering the critical questions, the main question was answered. As the questions guiding the study are justified it is also important to justify the study in the next section.

1.7 Rationale

Personal experiences as a high school learner and as a high school mathematics teacher, learning and teaching in a language which is not my first language largely motivated this present study.

Considering the fact that learners in South Africa are performing poorly in mathematics in the international context (Trends in International Mathematics and Science Study (TIMSS), 2003), it is hoped that the study will help to enlighten on the practices of the teacher as she helps learners access mathematical terms. The study will add to the literature generated by other researchers such as Kazima (2008), Setati (2005) and Adler (2001) who have studied language practices in multilingual classrooms.

1.7.1 Why South Africa?

South Africa is a multilingual society with 11 official languages. This means that each language may be represented in most classrooms. However, the teacher might not be able to speak all the languages; hence the classroom language of instruction is restricted to English, which is the language in which mathematics is taught. Therefore, this study explored how the teacher works within the different languages to help learners learn mathematical terms.

Despite widespread acceptance of the notion that improving learner performance may have a high economic and social payoff, according to TIMMS (2003), South Africa's learners have low attaining levels in mathematics compared to other learners in other African countries (van der Berg & Louw, 2006 cited in Chisholm & Carnoy, 2008). Furthermore, the South African government's own evaluations of ten years of democracy show little improvement in educational outcomes despite significant educational policy changes especially in mathematics (Department of Education (DoE), 2006). Among other factors for the poor performance of learners in mathematics is the underdevelopment of learners' mathematical language proficiency, which, in my experience, can be developed by first developing an understanding of mathematical terms in every topic they do.

1.7.2 Why English Second Language learners and why Mathematical terms?

Until very recently when some researchers (e.g. Setati, 2005; Kazima, 2008; Adler, 2001) stepped in to investigate the underlying factors of poor performance in mathematics, mathematics was generally accepted as a difficult subject. In their investigations they found out that, most schools in South Africa were experiencing intangible causes of this poor performance. Though, on the other hand the curriculum views mathematics as a discipline which enables creative and logical reasoning about problems in the physical and social world and in the context of mathematics itself (DoE 2005), the poor performance in mathematics shows that there is poor connection between mathematics as a Discourse and the communication of mathematics in classrooms.

Most African children in South Africa, including those in urban areas may have little or no experience of English before schooling because English is not their mother tongue. It, therefore, becomes very difficult for these children to understand and communicate mathematically in classrooms because they have to struggle with the meaning of the words and the formation of grammatical structures at the same time as they learn how to read and write in the language of mathematics. For this the curriculum should have a way to cater for such children in its policies so that these learners achieve sufficient level of fluency, confidence and vocabulary to enable them cope with more demanding and abstract formal knowledge through the English medium (Macdonald, 1991).

According to Sfard, Nesher, Streefland, Cobb and Mason (1998), language is a major route to the articulation of ideas. However, natural language is limited in its ability to describe mathematical notions. Therefore, teachers have an important role to help learners cope with the demanding abstract level of mathematics and all its formal knowledge which is needed in logical reasoning in order for learners to be mathematically argumentative (ibid). In such cases, teachers should expect learners to come to school with initial structures for learning which are rooted from their everyday experience or social backgrounds and should come to know these structures through learner’s language (Vygotsky, 1978). The teacher will be forced to move between languages and cultures, and unluckily, some learners whose first language clashes with the language of instruction might be at a disadvantage while those whose first language is the language of instruction are advantaged. For example, learners whose first language is English or Afrikaans can have their languages converted to academic rewards, a linguistic capital for success while second language speakers are marginalised (Zevenbergen, 2000).

Those with a linguistic capital can negotiate their way towards mathematical meanings of some terms which have different meanings or which are difficult to understand. Zevenbergen (2000) argued that some learners will gain access to modes of mathematics communication in classrooms some will not. Zevenbergen (2000) further argues that mathematics as a register has some language aspects which need to be considered; these are the vocabulary, the syntax and the lexical density. Teachers are supposed to teach learners the mathematics vocabulary if they are to understand the concepts. The vocabulary (terminology) carries the concept and it is how we structure the explanation (semantics of the explanation) and put the lens through which learners access the concept in the mathematical terminology as we teach (Zevenbergen, 2000)

From my experience as a mathematics teacher, I have observed that many second language learners experience a great deal of difficulty in understanding and expressing themselves mathematically. This difficulty is mostly caused by the fact that learners have to learn a mathematical meaning of a term in addition to its everyday meaning or that; the term is not part of their everyday meaning.

Mathematics terminology is highly specialised and seems difficult to understand when compared with the everyday vocabulary. It is through the language of mathematics, the mathematics terminology is to be learnt in order to get the precise mathematical meaning of the terms. Zevenbergen (2000) contend that language acts as a medium through which communication of ideas is made possible, and negotiation of ideas, meanings and concepts are delivered. Therefore, language is important in the mathematics discourse as discussed in the next section.

1.7.3 Why 'Language' in the Mathematics Discourse?

Many researchers such as Setati (2005) and Kazima (2008) argue that poor understanding of language of instruction, particularly language of mathematics, contributes to poor learner mathematical performance in multilingual classrooms. This became the most important concern in this study as the study investigates how teachers provide access of mathematical terms, which are in the language of mathematics, to learners. Constructivists in their learning theories have given more attention to language in learning, for example, through language ideas are shared and through language knowledge is acquired (Vygotsky, 1978). Vygotsky's strongest views were on language and learning. He gave more emphases on the social aspect of language arguing that the thinking structure is strongly influenced by language and cognitive development in a social process. It is through language that both spontaneous (everyday) and scientific (school) concepts are acquired. Therefore, learners acquire mathematical concepts through language.

It is very important for us teachers to pay more attention to how we can modify instructional activities in mathematics classrooms to accommodate English second language learners' needs and thus accommodating differences in our diverse learner population to help every learner learn mathematics (National Council of Teachers of Mathematics (NCTM), (2000)). Gee (2005) argues that language is one of the tools for engaging in discourse analysis, which means that, to engage in conversational arguments language becomes an important tool. Language is used by teachers and learners to negotiate meaning, and learners explore mathematical concepts through it as they grapple with mathematical situations in seeking their own understanding. Therefore, the teacher is only able to assess learners' mathematical discourse quality on communication and conversations through language, as a medium.

1.7.4 The importance of the study

The study will communicate a teacher's practices in facilitating access to the meaning of mathematical terminology by learners in a multilingual classroom in South Africa. The findings of the study will not only make teachers aware of the difficulties in facilitating multilingual learners' access to the terminology, but also realise that teaching of the mathematical terms is important in the mathematics teaching and learning.

Mathematics Education Officers might find the outcomes of this study important or relevant to their policy and teacher professional development programmes and adapt them for the purpose of improvement. The results of this study might be helpful to other teachers. By reading it, they may learn some helpful ways of explaining mathematical terminology and help their learners in accessing mathematical terms. Also, the understanding of teacher's practice gained from this study might help other researchers to extent it in their subsequent researches (McMillan & Schumacher 1993).

1.8 Why the Grade 11 teacher

Mathematics in the Further Education and Training (FET) band builds on what has been learnt in the General Education and Training (GET) band as it prepares learners for further studies (DoE, 2006). It is important for the teacher in the FET band to explicitly design generative activities which will provide a platform for multilingual learners to access mathematics through its terminology.

It was important to focus this study on the FET band because it is in this band teachers play an important role teaching for deeper understanding of most mathematical terms needed by learners as they prepare for their career paths. The FET band teachers have an experience in marking the matric mathematics examinations. From my experience as a marker, markers discuss learner mathematical representations of the examinations, and ways of improving especially when the results are poor. As a researcher, I assume poor representations are a result of poor understanding of mathematical terms; therefore, it was important to focus on this band because the mathematics we teach in this band comprise of critical terms which are important for learners to prosper in mathematics. Teachers in this band need to help learners cope with the demanding abstraction of mathematics as they develop logical reasoning skills and they should consider this band as a bridge between the GET band and the tertiary level, where a learner should be fully prepared for any mathematical pathway. Therefore, this is a preparatory band where teachers prepare learners for the world.

1.9 Conclusion

In this chapter, I have presented the broad picture of what the present study is about. In other words I have presented the problem statement, the rationale, the aim of the study and the research questions that guided the study. Below, the report outline of the study is presented.

In the next chapter, I will present the theoretical framework and literature review of the study.

1.10 The Report Outline:

Chapter Two

I describe the theoretical perspective of the study and the review of related literature

Chapter Three

The research design and method of data collection used in the study are described in this chapter. I discuss the sample, the research instruments, validity and reliability of the study

Chapter Four

This chapter presents the analytical framework of the study

Chapter Five

Data analysis and the presentation of results in response to the research question as to what are the teacher's practices in the Definition Discourse were revealed in this chapter

Chapter Six

This chapter presents the discussion on the teacher's enacted Definition Discourse

Chapter Seven

In this chapter the researcher gives her stance in the enacted Definition Discourse as conclusions of the study, discussed the implications, reflections, limitations and made recommendations for further research

Chapter Two
Theoretical Framework and Literature Review

2.1 Introduction

This chapter discusses other researchers' perspectives and findings on factors underlying poor learner performance in mathematics. It gives the outline of theories this study is based on and discusses how other people and researchers perceive a mathematical discourse and the language of mathematics. Furthermore, the review of the literature which includes literature on the role of the teacher in the mathematics discourse and of language in the teaching and learning of mathematics and its use in the mathematical social aspect is discussed.

2.2 The Theoretical Framework

In the research field of mathematics teaching and learning, a theoretical framework is very important for several reasons. One of the main reasons is that it provides a lens to understand how the data of the study can be interpreted and analysed.

2.2.1 The study's perspective

The study's theoretical framework is based on the situated and social-cultural perspectives of Gee (2005). I used Gee's (2005) notion of Discourse to explain a teacher's practice in a multilingual classroom. Gee (2005) distinguishes between two discourses: a Discourse (with upper case D) and discourse (with lower case d). Gee defines "Discourses" with a capital "D" as ways of combining and integrating language, actions, interactions, ways of thinking, believing, valuing and using various symbols, tools and objects to enact a recognizable identity and practice.

According to Adler (2001) language is understood as a social tool in thinking, enquiring and in communicating about mathematics. Teaching mathematics from a mathematical perspective involves talking in a certain way and using a certain language which is acceptable in mathematics and is different from other ways of talking. It is not only the ways of using language which enables the teaching of mathematics but it involves other symbolic expressions, ways of thinking, feeling, believing and valuing what is happening around (Gee, 2005) in order for it to be a mathematical Discourse.

2.2.2 The mathematical Discourse

In this study, I define mathematical Discourse as having particular ways of interacting, valuing, thinking, using certain actions, interactions, etc, which are different from other subject Discourses. A mathematics Discourse is precise and explicit, searching for certainty, abstracting and generalizing, these are the highly valued practices in mathematically oriented Discourse (Moschkovich, 2003). Mathematical statements for generalisation or meaning making can be those which are seen as claims or conjectures. For example, triangle as a mathematical term can be defined as a shape with three sides whose angle sum is 180 degrees. While generalising in mathematics is abstraction and is valued, the community of that practice should explicitly and precisely make applicable claims or definitions only with defined situations (Moschkovich, 2003). Likewise, multiplication is a way of making a number bigger, such a claim or definition should be situated in a certain set of numbers and not assuming it does in all number sets.

A mathematical Discourse, therefore, does not only include symbolic expressions, and ‘artefacts’ according to Gee’s list in general, but also extends to its own values, beliefs and perspectives. In order to participate in mathematical discourse practices one has to understand the universal mathematical talk and the ways mathematically competent people talk and act when talking about mathematics (Moschkovich, 2003). These Discourses we enact were there before us and most of them will still stay for longer even after we have left to be part of them, but the important issue is recognition (Gee, 2005). The teacher needs to put everything together in order to create a socially accepted classroom association which can be used to identify him as a member of a socially meaningful group as she engages learners in a particular type of activity. What the teacher does must be similar to what the mathematicians would do in order to continue the Discourse; unless the teacher changes the performance and these changed performances are recognizable, the Discourse can now be viewed as transformed (Gee, 2005).

2.2.3 The Definition Discourse

Mathematics as a subject is a Discourse whose genres and topics within any particular grade can be further broken down into smaller other Discourses with their own practices. Within the mathematics Discourse, terms which are specific to the mathematics Discourse have to be defined to the learners who might be meeting these terms for the first time. These terms require the teacher to use specific ways and artefacts in the process of defining them to the learners. The teacher defines the terms within a Discourse which I refer to as a Definition Discourse. The Definition Discourse is a Discourse on its own in the mathematics Discourse.

The Definition Discourse refers to ways in which the teacher explains mathematical terms in the classroom. According to Gee (2005) in a Discourse there are ways of using language, other symbolic expressions, and ways of thinking, feeling, believing, valuing that can be used to identify oneself as a member of a socially meaningful group. Therefore, in the Definition Discourse, the teacher has her ways of talking, thinking, valuing and believing when explaining mathematical terms to learners. For example, in a lesson there could be different Discourses taking place, e.g. the "Conceptual Discourse and Calculational Discourse" (Setati, 2005b). In a conceptual Discourse, for instance, mathematical concepts are discussed while a calculational Discourse is the part of the lesson where methods of calculating are discussed; this is where procedures and algorithms are discussed. In any Discourse the teacher uses the language in a particular way which may be different from other Discourses.

In the Definition Discourse there are certain valued practices. These practices may be manifest in the tasks that the teacher uses to teach definitions, and the practices could be shaped by the teacher's feelings and the importance she attaches to the definition of mathematical terms. It is crucial that the teacher exhibit good listening skills which are necessary in fostering fruitful interactions in class (Davis, 1997). Definition Discourse practices, for example, could involve instances where the teacher gives learners a platform to explain terms to each other or to the class, maybe in the public domain where learners report back after a task involving exploration of mathematical definitions. In other tasks learners could be teaching each other while the teacher facilitates the actions. This is an act of dispersing teacher's authority to collective class authority, building a community-established standard (Davis, 1997). According to Davis, this is referred as hermeneutical listening, which is the action of acting with learners in the explanation of the terms. All what is being discussed here, among other practices, is what constitutes the Definition Discourse.

2.2.4 Teacher's approach to the teaching of mathematical terms

This study defines mathematical terms as mostly those terms which learners may meet in the mathematics classroom for the first time and may not be part of their everyday knowledge. Vygotsky (1978) referred to these terms as scientific words and are often difficult for most learners to understand and grasp their meanings readily. Some of the terms do not make sense in learners' everyday language and they only make sense in mathematics or some might have different meanings in different contexts (Adams, 2003). Therefore, the teacher has to explain the terms in such a way that learners can develop meaningful, correct, and applicable definitions of these terms as she engages them in the mathematical sense-making Discourse (Adams, 2003). Here teachers have an important role to play in learner's conceptual development in the conceptual Discourse as they introduce learners to these mathematical terms (Vygotsky, 1978).

Because mathematical terms are explicit and interconnected, this makes them different from the spontaneous or everyday concepts. Teachers should explicitly teach the terminology, rules and conversational norms associated with the new mathematical terms, help learners comprehend and use the discourse to deepen their understanding. This means that, where possible, the teacher should define a mathematical term by its contextual meaning in mathematics. For example, if a teacher is giving an explanation of the phrase 'Pythagoras theorem', she might need to tell learners that Pythagoras theorem can only be used or talked about when people are solving problems associated with a right-angled triangle. In this explanation, the teacher will be using language associated with a triangle and using different ways of thinking to bring learners to an understanding of the phrase.

When defining mathematical terms in class, the teacher may draw on her own experiences for the definitions. She may use textbook and/or dictionary definitions, situational and specified definitions or working definitions to ensure learner understanding (Moschkovich, 2003). Generally, most learners bring their informal definitions to class as prior knowledge (Vygotsky, 1978); therefore, it is imperative to transform these definitions by using them as a platform to introduce them to formal definitions (Adams, 2003). For example, learners might have an initial definition of a circle as a round thing (informal); the teacher can then transform this idea to a more mathematical idea (formal) because there are many round figures such as a sphere.

The teacher may use other people's verbal definitions or borrowed words from other texts (written or spoken) as she explains mathematical terms. Gee (2005) argues that people often write or speak words which are related to other texts and be able to mix them properly to come up with the meaning of what is at hand. This means that a teacher may incorporate different texts or words in defining terms but in a proper way which maintains the mathematical meaning of the term. This practice is called intertextuality (Gee, 2005). The process of intertextuality in the Definition Discourse is when the teacher uses a newspaper, other books different from the class' textbook or people's verbal words to define the term she has introduced in class. The teacher might use objects (Teaching and Learning Support Material (TLSM)), specific places e.g. field work, and non-verbal practices to accompany the other practices (Gee, 2005). Therefore, I proposed to investigate how the teacher incorporates oral and written texts in explaining the mathematical terms in the Definition Discourse.

In the process of intertextuality the teacher may incorporate words, ideas, actions and non-verbal expressions from other people or texts, indirectly or directly, in an attempt to make her point or idea clear to the learners. However, some texts that are borrowed may contradict the idea in discussion; in this case the teacher must be very careful in order to maintain a precise and explicit definition she wants the learners to learn. The teacher may use facial expressions, gestures and body movements to accompany some verbal expressions as she emphasises a point in the explanation of the terms. In Gee's terms non-verbal expressions are defined as Grammar Two.

When the teacher goes to class, her intention is to develop conceptual understanding of what she is going to teach. In all mathematics lessons there are mathematical terms learners have to learn and use in their mathematical talk. Having such an intention or focus, a teacher has certain kinds of practices she carries out in the classroom, the resources she calls upon, the objects and the material items of the culture she cultivates in the classroom (Gee, 2005) as she explains the mathematical terms. Discourse, according to Gee, is used to explain how language can be used as a resource by the teacher when explaining the terms because Gee considers that language creates a political view when people talk and write. For example, in the class, the teacher may use a certain language to project herself as a particular 'who' while engaging learners in a certain activity of mathematical terminology acquisition.

As mentioned earlier, Gee (2005) uses discourse with lower case "d" to mean language-in-use or stretches of language (Adler, 2001). This is the language which will be used in the class by the teacher in an attempt to explain mathematical terms to the learners within the Definition Discourse. However, Gee argues that Discourses do not only include language but also symbolic expression and objects among other things, which are specific to a given Discourse. For example, within the mathematics Definition Discourse, the teacher may use certain objects such as models to help learners master the given mathematical definitions of terminology. Certain classroom practices may define the uniqueness of the community in the mathematics classroom. For example, the way the teacher wants her work presented by the learners as she defines the terms is what makes this class a different community from other mathematics classrooms taught by other teachers. The teacher might want learners to arrange their work the way she does it on the chalkboard or might instruct learners to underline the defined terms, or show their work as follows:

Mode: *Is a number with the highest frequency (appearing most).*
We mainly deal with it when doing averages in statistics

Discourses are specific depending on the situation. For example, the Discourse of mathematicians is very different from that of historians because their talk and their thinking about the world are different though the mathematical Discourse itself is historically situated (Moschkovich, 2003). Mathematical arguments have changed over time as Gee (2005) argues that new Discourses emerge while old ones die so do mathematical definitions. Moschkovich (2003) contends, therefore, that mathematical definitions have changed over time and she gives an example of a definition of a function which she says has changed throughout history, from a relation between numbers to a mapping between two sets.

Another practice of Discourse change is in the different mathematics classroom interactions. For example, the interactions where teachers would ask questions looking for a predetermined answer have been replaced by the teacher using learner responses to start classroom conversations, while questions seeking correct answer only are replaced by open-ended questions. However, Gee's notion of situated and social-cultural perspectives does not talk about how the teacher should interact with learners in the ways of combining and integrating language, actions, interactions, ways of thinking, believing, valuing and using various symbols, tools and objects in class. However, this was done by Scott, Mortimer and Aguiar (2006) in their study. Scott et al. (2006) discuss interactions taking place in what they call *Authoritative* and *Dialogic Discourses.* Therefore, Scott et al. (2006) was used in this study to illuminate on how the teacher interacts with the learners as she explains mathematical terms. Scott et al. (2006)'s framework was used to categorise teacher strategies as either 'Authoritative Discourse' or 'Dialogic Discourse'.

According to Scott et al. (2006) Authoritative Discourse and Dialogic Discourse is a process where the teacher makes an initiation (authoritative presentation) for a meaning making process (dialogic). Likewise, every Discourse has its own language that is used in the process of taking part in that discourse (Gee, 2005). In the two Discourses, language use might be different. The language the teacher uses when presenting the terminology (in the Authoritative Discourse) may be different from the language she uses when she is taking part in the Dialogic Discourse as she facilitates learners' access to the terminology especially in a multilingual classroom. The study looked through these Discourses to understand the language-in-use.

Scott et al. (2006)'s framework is based on a sociocultural perspective of teaching and learning. Central to this framework is the concept of 'communicative approach' in which dialogism is a universal property of language. The study is situated in a multilingual class, therefore, if the teacher asks a question, learners will only respond if they understand what the teacher is saying and are familiar to the language the teacher is using, and are also able to know the manner in which they are expected to respond to teacher's different questions. This is common with most authoritative classroom interactions and in this the initiation-response-evaluation (I-R-E) pattern is commonly used Scott et al. (2006).

The I-R-E pattern is where the teacher initiates the move in the lesson and the learners respond to it, then teacher makes a follow-up of that response. It is the teacher's initiation and follow-up, teacher's response or feedback, which are important in this study as they play a role in learners' access to the mathematical terms. Normally, it starts with the teacher's question about a concept or a term she is to teach about, it can be said orally or a written text on chalkboard and then learners respond to it. When learners respond they look forward to teacher's response/feedback, in accordance to theirs. Teacher's feedback can create conversational learning, learner-learner or teacher-learner this can be through re-voicing (Herbel-eisenmann, Drake, & Cirillo 2008; Enyedy, Rubel, Castellón, et al., 2008; O'Connor & Michaels, 1996) or paraphrasing learner responses (Pressley, Goodchild, Fleet, Zajchowski, & Evans, 1989). The terms re-voicing, rephrasing and paraphrasing are going to be dealt with in the literature review section although they are not the key issues to the study.

In the I-R-E, if the teacher has a specific point which she wants to focus the learners on in a lesson, she presents it in a way to provoke learners' certain responsive manner. Teachers might have different patterns of operation in their mathematics classrooms but their operations make up the Authoritative Discourse. For example, when introducing a mathematical term, the teacher might write it on the board as she explains the term, but she does not allow learners to write as she talks in order for them to understand the explanation, intending to give them time to write the notes later. Therefore, the teacher's practice includes the ability to create and engage learners in sound patterns of interactions at the same time controlling the class.

All classroom interactions are dialogic because every word uttered responds to previous utterances in anticipation of responses from others (Bakhtin, 1986 cited in Scott et al., 2006). Scott et al. (2006) refer to classroom activities as 'public performance' and argue that it is led and directed by the teacher according to her plan "script". In this the teacher has to develop a mathematical story on the social context of the classroom which will give learners a platform to internalize the new mathematical ideas which are being introduced. The teacher may do this by building the formal definition from informal definitions because some oral informal definitions may be used to reconstruct a story of mathematical discoveries which learners are meant to discover (Moschkovich, 2003).

What kinds of definition activities does the teacher have to engage learners in, to access mathematical terminology? Mathematical terms are an important component in the mathematical discourse. The mathematical Discourse according to Gee (2005) is an ‘identity box’ where ways of thinking, acting and talking make up this box. Each discourse has its own kind of talk, for example, a talk which makes members of a discourse be able to identify one another.

We must use both the discourses (the small “d” and the big “D”) to talk about mathematics, and to develop the ability to use the discourses. Gee (2005) says, there are two ways to acquire this ability. One of the ways is informal, through authentic, ongoing exposure to ‘talk’ and ways of being. The other way is formal, learning it in school. This study’s emphasis is on the ability acquired in school. The school enables a systematically studied Discourse, identifying its norms, routines and rules allowing one to gain a deeper understanding of its functional ways and providing one with tools to effectively use the discourse.

2.2.5 Conclusion

As discussed above, there are many mathematical Discourses taking place in one mathematics lesson in the classroom. For instance, these Discourses stretch from what happens before the introduction of the mathematical term and what happens during and after the introduction. This is what Van de Walle (2004) calls a three-part lesson format. In these three stages of a lesson there are multiple Discourses taking place. The study focused on where the mathematical terms were explained by the teacher in these three stages of her lessons. This means that it focused on where the term was explained by the teacher or learner and where learners’ access to mathematical terms was being facilitated. The practices the teacher employed in explaining the term in order for learners to understand in all these three stages are the ones which built the Definition Discourse. Below I engage the literature review of the study.

2.3 Literature Review

It is also, in the research field of mathematics teaching and learning that literature is very important. It provides the researcher with other researchers’ understanding about the phenomena under investigation, thereafter, use that understanding to substantiate arguments, claims and/or researcher's position in a report.

2.3.1 What is explaining and why is it important?

Explanation in mathematics has played an important role in the development of mathematical knowledge (Mancosu, 2001). Explaining is a context based feature. Each explanation is correctly connected to the characterising property of what is being explained in a sensible way but does not make sense if the entity which is being explained is substituted by another entity that does not have that property, though it could be of the same family (Grosholz & Breger, 2000). For example, if the explanation is about the x-axis it cannot be switched for the y-axis though they are of the same family, the Cartesian plane.

The explanatory power depends on the teacher's knowledge around what is to be explained otherwise some terms will remain unexplained. The teacher's knowledge should include knowing the important facts or key terms in what she is teaching and the ability to set forth the truth of the proposition by differentiating it from what it is not. Though some terms can be non-explanatory or self-explanatory, most of them are explanatory. Teachers define mathematical terms, concepts or ideas in any way which suits their learners, because explaining is contextual, while retaining the conventional knowledge of what is being explained. But what is important is that teachers need to have various ways of explaining the mathematical terms. For example, explaining through demonstration establishes not only the universal truth but also the necessity or importance of what is being explained (Grosholz & Breger, 2000). Among the importance of giving universal explanations is the use of the mathematics discipline as an explanatory tool in other areas such as Science, for example, geometry in the areas of pure mathematics is used as an explanatory tool in physics. Therefore, the information teachers give to learners in the mathematics classrooms should be true to be used in other areas.

Explaining is one of the instructional practises teachers are executing in the mathematics classrooms as a way to help learners access mathematical knowledge and there are no explaining standards stipulated for this execution. Some terms can be explained in terms of others while some by using other terms, what is important here is to use appropriate clear terms in the explanation so as to maximize clarity of the mathematical term, because the clearer the term become the more its meaning is accessed by learners. Explanations vary over time and also among teachers of different classes and schools teaching the same terminology, however, any theory of explanation in mathematics must account for the terminology being explained (Mancosu, 2001).

To be able to define or explain mathematical terms depends on what we already know about the term. For instance, to define the term 'mean' when we already know that it is a kind of an average and also when the teacher provides information about the term (Lobato, Clarke & Ellis, 2005) to help learners define the term. Therefore, definitions are statements of what things are based on what we already know about the things (Bergh & Theron, 1999). In the same context of defining objects, though in this case we are defining terms, Marton, Runesson and Tsui (2004) and Runesson (2005) assert that it is easy to know something from what it is not. This means that when explaining some terms, learners can understand them quickly or easily when their meanings are contrasted with what they are not. For example, the term 'mean' is not the mode neither the median though all are kinds of averages. Therefore, the term 'mean' should have its distinctive definition from the other averages in order for the learners to understand its meaning.

In mathematics we do have explanatory proofs, counter examples, diagrams, demonstrations and also emphases on key terms which can be used in explaining terms, concepts, ideas and facts, and an explanation is the one that comes to be and continue to be (Grosholz & Breger, 2000). What has been explained here shows that explaining in mathematics classrooms has received much attention and has been regarded as an effective teaching practice. Therefore, there is no doubt that mathematical explanations in a mathematics classroom do exist. This study seeks the explanation of mathematical terms in one classroom, and the next section gives an explanation of a mathematical term.

2.3.2 What are Mathematical terms?

The words 'terminology' and 'vocabulary' according to this study mean the same thing and are the key factors in the mathematics communication process. Mathematical terms are mostly the broad theories taken as wholes rather than just terms or short phrases (Weiss &

Lee Kavanau 1957). They are broad in the sense that they carry with them the truth of the theme to be taught holistically and if the theme is not understood then the mathematics it carries is not delivered. A mathematical term is a specialised word used to communicate or to carry the meaning that may or may not make sense outside the mathematics discipline (Adams, 2003). It is in that specialised word the mathematical meaning can be found and the meaning comes about through its usage in language of mathematics as participants use it to know the world (Zevenbergen, 2000; Adams, 2003; Gee, 2005). Therefore, it is possible that the mathematical terms that learners meet in class may not be part of their everyday language, hence difficult to understand.

Mathematics participants use words of a special 'register' to write and speak in communicating mathematical arguments. This special 'register' is called the mathematics register, Pimm (1991). The register uses special words with special meanings only in the discourse as well as ordinary words which have different meanings in both mathematics and ordinary English; such words are referred to as paradoxical jargon terms (Shuard & Rothery, 1984). Examples of such words or phrases are: *product, tree diagram, volume etc.* Zevenbergen (2000) argued that an extremely specialized vocabulary among many is the highly technical terminology of mathematics. Therefore, it remains meaningful in mathematics only, for example, the term *percentage.* Pimm (1991) argues that the register's terms and symbols are mathematics specified and often unfamiliar to learners. For example, words like volume other than 'capacity'; function meaning an equation other than a 'party'; symbols like – (subtraction sign) other than a dash. Therefore, the dissemination of the mathematical meaning or idea carried in the term is very important in the mathematics discourse.

The mathematics register is considered as the set of terms and grammatical constructions that are thought to be most appropriate to communicate mathematical ideas clearly, concisely with a greatest amount of meaning to learners (Pimm, 1991). Moschkovich (2003) argues that, it is important to understand how and when the mathematics register is to be used and this resides with the teacher. The teacher should provide the opportunities for learners to use the terms constituted in the register the way mathematicians would use them.

Teachers need to help learners develop meaningful, correct and applicable definitions of the terms in the formal contexts, but the problem they face is how their knowledge about mathematical terms and their practices can help to put right the meaning of the terms with sufficient precision to ensure that each term has a determinate value to learners (McGee, 1997). To help learners develop, the teacher should use or have to use learners' informal definitions as a platform to construct their own understanding of the formal ones (Adams, 2003). In the discourse, the teacher needs to facilitate learners' understanding and encourage their commitment to what is going on in the classroom of mathematics by employing discourse interventions which increase learner participation and mathematics understanding. The teacher could employ interventions such as rich questioning techniques, paraphrasing for English second language learners to understand, summarizing, re-voicing, listening and also giving learners space and time to think as they engage with mathematical problems. Why we need to paraphrase or re-voice in a multilingual classrooms is explained in the following section.

2.3.3 The Discourse of the classroom

People acquire their primary discourses spontaneously, but secondary scientific discourses have to be acquired through deliberate teaching (Gee, 2005; Vygotsky, 1978). According to Gee (2005), a mathematical discourse is a secondary and a special type of discourse which deals with objects, quantities and shapes. Secondary discourses are those which oppose discourses which people grow up with (Gee, 2005). A Mathematical Discourse is the special dialect of English that is used to communicate mathematical reasoning and the vocabulary that describes the behaviour of mathematicians and learners of mathematics when doing mathematics as well as their attitudes towards various aspects of mathematics (Wells, 2002). This fixes the Discourse to a formal setup. Deliberate teaching of these secondary discourses is a communicational approach to cognitive development of learners. Sfard (2007) combined the two terms communicational and cognitive into 'commognitive' to mean that, thinking is communication and learning mathematics is to modify and extend one's discourse. And in this, the teacher's role is to guide the development of learner's skills in the mathematics Discourse using language as a tool. In this case mathematical English is used.

Mathematical English is a foreign language which has mathematical use of words and phrases that cause problems for learners, especially second language learners studying mathematics at an abstraction level. It uses words which sometimes have different meanings, in the mathematics Discourse and in English (Adams, 2003), for example, the word 'reflection' in mathematical transformations and 'reflection' in English have different meanings. Learners also meet some new words which have their meanings only in the discourse such as the word 'square' whose meaning is within the mathematical discourse.

A mathematics discourse is important for professional growth and helps learners to take charge of their own mathematical learning in the meaning making. A discourse can make thinking public and also create opportunities for learners to negotiate meaning with their teacher and agree on those meanings. It provides support for developing one's thinking, through the usage of language, questions, probing, and ideas of others (Cobb, & Bauersfeld, 1995); it enables us to connect a learner's own everyday language with the specialized language of mathematics, mathematical terminology.

A mathematics Discourse is an iterative and interactive process in which teachers engage learners in conversation about mathematical ideas at various cognitive levels through talking, asking questions, demonstration and writing. These interactions can be teacher-learner, in this, the teacher approaches teaching through an authoritative communication which may give platform to dialogic communication (Scott et al., 2006) of learner-teacher, learner-learner, and learner-class/group or individual reflection through oral or written documents. Scott et al. (2006) called these classroom articulations, patterns of the initiation-response-evaluation (I-R-E) as the teacher simplifies the mathematical terms for learner understanding. Similarly, Zevenbergen (2000) sees teaching as a three-part interaction where the teacher initiates, learners respond and teacher evaluates.

In the I-R-F, the teacher initiates the class activity in anticipation of learners' response; following to that response is the teacher's response or feedback which is important in this study and it does play a role in learners' access to the mathematical terms. From learners' responses, the teacher may see a need to paraphrase (Pressley et al, 1989) what she had put in front of learners, putting it in simpler ways for them to understand. For example, the phrase ‘parallel lines’, if the learners finds it weird to understand them as lines which will never meet, instead the teacher can paraphrase the definition to, lines which continue keeping the same distance between them and gives an example of the opposite edges of a rectangular table as parallel lines. This paraphrasing can make it simpler for learners to understand, thus, helping them crack the code of the term (Zevenbergen, 2000) in order to access the meaning. Paraphrasing is dealt with later in this section. To assess their understanding, the teacher can ask them to give examples of objects or areas where parallel lines can be identified, the examples given can be informal or formal, the teacher should welcome them all and build on them to bring a formal understanding of ‘parallel lines’.

However, simplifying the mathematical terminology may actually obstruct the meaning, rather than enhance the learners’ ability to make sense of it. Gorgorio and Planas (2002) warn that when concepts are oversimplified it becomes more difficult for learners to make mathematical connections between ideas. In other words, teachers should be cautionary when paraphrasing definitions of terms for the learners.

Khisty and Chval (2002) argued that teachers play an important role in providing learners with access to mathematical terms and ways of talking (Gee, 2005) therefore, mathematical terms must be explicitly taught. Teachers help learners learn how to communicate mathematically by modelling the mathematical discourse, which includes the appropriate use of mathematical terminology, by restating learners’ ideas in more precise mathematical terms through, for example, revoicing or paraphrasing and by providing learners with opportunities to use the terms contextually. Khisty and Chval (2002) found out that a grade 5 teacher created repeated opportunities for English language learners to come in contact with the mathematical language by populating the classroom environment with mathematical terms and mathematical ways of talking. This suggests that teachers may use wall charts with mathematical terms and their definitions, diagrams or mathematical statements illustrating the use of terms, which, with time learners acquire and appropriate them as their own (Vygotsky, 1978), and thus learners’ knowledge construction.

In another study by Webb and Webb (2008) ‘exploratory talk’ was found to be very important as teachers practically put in place activities which helped learners construct knowledge through critical engagement in collaborative justification of ideas in a ‘thinking aloud activity’. For example, the classroom interactive talk which gives learners authority over their learning in the defining of terms where the teacher initiates by introducing the term on the board and instructs learners to define the term as she takes a position of a facilitator. In this talk the teacher controls the use of the language of mathematics because we assume learners do not have the mathematics vocabulary yet. Learners can only have the mathematics vocabulary if they are made to access it in class as the teacher teaches them the mathematical terms and their mathematical meaning. This can be done through teacher’s explanation of the terms. According to Scott et al. (2006) the initiation of the teacher, which is within the authoritative discourse, is very important in guiding the learners to meaning making of the mathematical terms.

Other research has considered a broader perspective of what it takes for English language learners to communicate mathematically in a multilingual classroom. Moschkovich (1999) in her study of a third grade multilingual class documented some strategies that the teacher used to support learners’ ability to communicate their thinking during whole class discussions in the language of mathematics. One of the strategies was to accept learners’ contributions even if it was unclear and probing learners for clarification of those ideas. For example, if the teacher asks learners to define a ‘quartile’ a learner might give his or her definition as “…it is a quar… quarter of…something”. Such a definition is not clear whether the learner is referring to a quarter of a chicken or a quarter of bread they buy from school tuck shops. Cases where learners’ intended meanings are not clear or only partially expressed are mostly common when learners communicate their thinking in a language they are in the process of acquiring (Adler, 1997, 1999).

However, Moschkovich commented that in such cases the teacher should support the leaner by further clarifying his idea, asking probing questions and listening carefully to the idea. In addition and more importantly, the teacher can use the sociolinguistic mechanism of re-voicing (O’Connor & Michaels, 1996), in which the teacher strategically reports another learner’s utterance to the class through the use of repetition, rephrasing, or expansion upon the original idea (Forman, McCormick & Donato, 1998). Moschkovich (1999) argues that through re-voicing the teacher does not only communicate to learners that their contributions were accepted, but also opens a space for learners to comment on the correctness of the teacher's explanations, thereby creating more opportunities for learners to understand the meaning of the terms.

Re-voicing in this study is where the teacher re-utters the learner's response through repetition, expansion, rephrasing, and reporting (O'Connor & Michaels, 1993; 1996; Herbel-Eisenmann et al., 2008; Enyedy et al., 2008) a strategy which can be fused with teacher's practices in the classroom. This strategy has been identified as an important discourse practice in the teaching of mathematics and, is arguably something that teachers could use when teaching. Herbel-Eisenmann, et al. (2008) encourages teachers to take learners' utterances and treat them as appropriate pieces of information for comment and re-voicing so that the class could hear what others were saying. Re-voicing focuses more on commenting on learners' utterances and reformulating them in order to advance teacher's plan (O'Connor & Michaels, 1996). It can change the contribution slightly so as to drive the discussion in a profitable direction of defining the term. The teacher may be simply rebroadcasting the learner's utterance to reach a wider learner audience than the learners who would have been reached at first. By re-voicing, the teacher further externalises and clarifies the very learner's definition for him to understand it better than he had put it. Therefore, re-voicing promotes deeper understanding of mathematical terms as the teacher relates learners' responses to one another in the facilitation of learner access to terminology.

In addition to re-voicing, another sociolinguistic mechanism which a teacher can use is paraphrasing for understanding. Paraphrasing is a teacher provided responsive feedback which is thought to be equally profitable in the teaching of mathematics (Pressley et al., 1989). Paraphrasing can be given as either additions to the task, hints, clues, actual class definitions, information about the new term which can be used or examples. But all these provisions should preserve the semantic rigor and precision the term provides i.e. preserving the mathematical meaning of terms. This strategy also helps teachers in discouraging learner memorization of definitions because it promotes learner understanding.

This study, also argues that teachers can maximize learners' access to mathematical terminology if they support their explanations of the terms with a number of resources that include language, inscriptions i.e. chalkboard use or worksheets, gestures and physical objects (Gee, 2005). In this way the teacher is applying distributive thinking in her teaching practices. The teacher's strategic management of this variety of communication forms prepares learners to reach for the mathematical terminology she is teaching. The teacher can also give class discussion instruction. This helps English second language learners to get help in accessing the mathematical register and develop the register's skills from English first language peers who are at an advantage of their language being the language of instruction, a help that is probably unavailable in their everyday life. English first language learners' advantage comes from the fact that their language can be converted to academic rewards a linguistic capital which can help them negotiate their way towards mathematical meanings of mathematical terms (Zevenbergen, 2000). The following section outlines the role of the teacher in the mathematical discourse.

2.3.4 The role of the teacher in the Mathematical Discourse

From my experience as a teacher, a mathematical discourse relies on three related features of teaching; these are teacher's intentions, teacher's action and the learners' interpretations of the action. The teacher's intention should be to promote coherence and sense making rather than reproduction of procedures. The teacher may have a range of specific intentions for different actions. For example, a teacher may create a space for learner engagement, thereafter introduce a new idea to be developed or may provoke disequilibrium in learners' thinking by providing a new idea which is a counterexample in order to reorganize learners' schemas (Piaget, 1978). The teacher's role in the classroom is to provide a healthy mathematical discourse on which learners build confidence and judgemental skills on whether they are on the right track or not when working on mathematical problems. That is to make discourse a tool to help them productively solve problems, and support productive disciplinary engagement of learners in problem solving (Scott et al., 2006). In this case the teacher uses the discourse for teaching mathematics and also for professional growth.

Stigler and Hiebert (1998) report similar roles for teachers and learners in mathematics classrooms in Japan, where mathematical discourse is an integral part of instruction. On the same concern Lobato et al. (2005) argues that teachers should guide the development of mathematical discourse, facilitate conversation through rich engaging activities where learners construct their own meaning and avoid the telling discourse. Teachers should create conducive environments to shape the discourse and open up for learning and learner thinking, conjecturing, question asking and allowing multiple-entry points to problem-solutions. As teachers we may miss what learners need for good conversations to take place but it is important to keep asking ourselves, are we sharing the same understanding and commitment to what we are doing in the classroom of mathematics?

Teachers should also know that, as mathematical ideas develop they also change hence mathematical discourse change as new discourses emerge while old ones die (Gee, 2005). This change may be political, economical or societal but all the same professional growth is needed along those planes. For example, the curriculum change from Bantu education to Curriculum 2005 in South Africa (DoE, 2005) needed teachers to be trained in the implementation of C2005 in order to align their practices with what was on offer. During this time every learner was expected to do mathematics in the language of mathematics because no other language had developed its mathematical register except the Afrikaans language. Therefore, the teacher should be able to promote mathematics through the language of mathematics which is important to both learners and teachers because it increases better chances of meaning making within the discourse.

Since it is the word which carries the meaning, it is important for teachers to provide an opportunity for learners to learn unique correspondence between signifiers (words) and signified (concepts) (Zevenbergen, 2000) within the discourse. Furthermore, where some of the signifiers have different meanings the small "d" becomes a big "D" (Gee, 2005) when its meaning is directed to the discourse of mathematics. Therefore, in this situation, learners should be able to decipher the specificity of the mathematical words to avoid the invitation of a very different discourse.

In order to develop a mathematical discourse in the classrooms, as teachers we should be guided by self-directing questions such as:

- How do I facilitate a mathematical discourse among learners of different diversity (cultural, linguistic, ethnicity etc)?

- What do I know about the discourse and how do I translate it into practice?
- How do I plan for mathematical terminology accessibility?
- What type of class activities should I provide in order to promote a meaningful discourse?
- What strategies should I use to promote rich communication and conversations?
- How do I assess learner's mathematical quality on communication and conversations?
- How do I use technology if available to promote mathematical discourse?

(Ross & Bruce, 2007)

With such questions in mind, learners' accessibility to mathematical terms may be endorsed. But in order to facilitate this accessibility, it is more important for the teacher to be able to identify a mathematical term and design her instructional activities around the term. The definition of a mathematical term according to this study is what the next section is discussing.

But to be helpful, teachers also need to promote the use of the language of mathematics and not avoiding it as what other teachers are doing in some schools as the next case is portraying.

A case in a school

It is not known how teachers explain mathematical terms to learners in mathematics classrooms; however in other areas of mathematics learning, some discrepancies have been noted in a certain school. I recently interviewed one mathematics teacher, in my previous assignments on choice of mathematical textbook(s). The teacher admitted that he chooses a textbook with many symbol problems (e.g. algebraic expressions or equations) and less word problems. His reason for such a choice was to help learners whom English is a second language not to struggle in trying to find hidden mathematical concepts in words. The teacher showed misconceived knowledge on mathematical symbols in that, in order for learners to effectively read mathematics, be it in words or symbols, they need to decipher meanings of those words or symbols first (Adams, 2003), thus developing a mathematical register (Pimm, 1991). With such a reason it shows that the teacher is not aiming at promoting mathematical understanding in learners but he is just doing his duty. Such a teacher would not design a valuable instructional activity for any mathematical term because the terms are not important to him what is important is for learners to simplify given symbol problems.

This also shows that teachers may avoid explaining mathematical terms to learners and opt for symbolical problems in which they only teach procedurals. Teachers should not help English second language learners by avoiding more worded texts because words (signifiers) guide learners to more important mathematical content matter (Morgan, 1998).

In addition, from my experience as a teacher, most Grade 11 second language learners fail to understand some of the mathematical terminologies especially in the word problems. They fail to use appropriate mathematical language to explain or justify their solution strategies and cannot argue their mathematical positions or talk-out their thoughts because of poor understanding of the mathematical language. This could be because some teachers avoid teaching topics with mathematical terms which include word problems for the reasons such as: teacher's lack of knowledge in the terminology, or teacher's poor practices in the facilitation of access to meaning of mathematical terms by learners. Therefore, in the above case, the reason which was given does not sound professional, as teachers, we need to bring the language of mathematics to the learners' understanding as they access the meaning of the terms.

2.3.5 Relationship between mathematics and language

The findings by Dlamini, (2008) in the research on language policy in Swaziland showed that mathematics and English examination results had a weak relationship, which meant that learner's pass in English had little effect on his/her passing mathematics and vice versa. Thus, those who would have performed well in mathematics does not necessarily mean they would have done so in English. This shows that one does not need to be fluent in English language in order to understand mathematics. I want to believe that Mathematics is a language on its own and is different from ordinary language. My assumption is, if there are borrowed words from ordinary English to mathematics then those words are part of the mathematical language.

The ordinary English language words become part of the mathematics vocabulary because sometimes their meaning in mathematics might be different from their meaning in ordinary English. For example, the word ‘similar’ in similar triangles, in ordinary English it can mean looking alike, but mathematically for triangles to be similar we consider certain rules which are: corresponding angles should be equal and ratios of corresponding lengths should also be equal. The difference in these meanings is that in the mathematical meaning the sides of the triangle should be proportional in length and the angles included should be equal, while the English version there is no measurement to ascertain similarity. Therefore, mathematics and English can be seen as different discourses sharing same words which some of them if not most have different meanings to both discourses.

In trying to find ways of helping learners use mathematical language to learn mathematics, Setati and Barwell (2008), explored a new approach to teaching and learning mathematics in Gauteng’s (South African province) multilingual classrooms. The approach involves teaching and learning mathematics in both English and native languages. They called this a ‘code switching’ approach. In their analysis, they found that the approach was effective in South Africa’s multilingual context. Code switching approach can help in the defining of terms if it is done with the preservation of the mathematical meaning of the terms.

Vorster’s (2008) study carried out in North West region in South Africa, discussing on the mathematical terminology, has found that teachers and learners having been used to mathematical terms in the language of mathematics were not very sure to code switch it with Setswana terminology. These teachers were very concerned about the use of Setswana for mathematical terminology because they were not sure of other mathematical terms, that, if they are put in Setswana will they give the same meaning as in the language of mathematics. Therefore, if code switching is to be used a mathematical register of different main languages has to be developed for this approach to be effective. This might help the teacher to reach learners’ understanding especially those who struggle with the language of mathematics and it will motivate learners if they are to learn mathematics with understanding. The next section enlightens on an article by Kazima which gives a review on how other countries have viewed the mathematical terminology in multilingual classrooms.

2.3.6 Teaching Mathematical terms in a multilingual classroom

Kazima (2008) in her article titled 'Mother Tongue Policies and Mathematical Terminology in the Teaching of Mathematics' discusses the implementation of language policies which deal with mathematical terminology and gives light on some different policy options available for mathematics teaching in multilingual classrooms which seems to support code switching. She makes an example of three countries Tanzania, Nigeria and Malawi which have developed different approaches to multilingual classroom instruction. The most important option was the development of mathematical terminology or adoption of English terminology in African languages to assure correct mathematical meaning. Teachers were trained to use language effectively in the combating of poor mathematical terminology understanding (Kazima, 2008). Such policies help to do away with the learners and teachers' fears in using African mathematical terminology and most importantly help teachers to disseminate correct mathematical meaning through African languages, thus code switching.

Kazima's discussion on language policy gives an assurance of mathematical meaning and certainty in teaching mathematics through code switching as her study answers the question: How can a country deal with mathematical terminology when teaching in the mother tongue? If such a policy is developed in South Africa then teachers are assured of the same mathematical meaning through code switching as it is through the language of mathematics, this also improves reading and understanding mathematics.

2.3.7 Reading proficiency and Mathematics attainment

Mathematics teachers may consider giving learners some mathematical reading texts, with no problem solving, sort of glossary of mathematical terms which they may engage with prior to the coming lessons. This will enhance learner understanding of the terms when the teacher introduces terms after learners have explored the terms first on their own. This will help in bridging the mathematics literacy gap (Bohlmann & Pretorius, 2008). Hanrahan (2009) argues that in the last century, teachers in the United States of America (USA) would give empirical activities with less attention to literacy skills. Her investigation was on literacy-teaching practices as a learning activity which supports learners with low literacy skills. She advocates that more reading and writing skills should be taught alongside mathematical content especially in double periods of the lesson because access to terms is also through more practice in reading as is in writing.

Bohlmann and Pretorius (2008) found that mathematical attainment is closely linked to reading proficiency. This implies that teachers should provide learners with reading practices, for example, after writing the term on the board the teacher may ask learners to read the term for the class so that the teacher corrects learners' pronunciations if need be before defining it. Because some terms can give their meanings by the way they are read and pronounced, for example, the terms 'interior' and 'exterior', this becomes easy for the teacher to attach the mathematical meanings of these two terms. The former one has 'in' for inside and the later has 'exter' for external/outside these are clues which can then be used to define the terms for learners to access the meaning, for instance, when dealing with angles in a triangle.

Sometimes reading in mathematics is taken as a non-mathematical aspect to be considered in teaching and learning of mathematics (Curriculum 2005) and is overlooked as people believe that we do mathematics (Stein, Smith, Henningsen & Silver, 2000) and not read mathematics, but the fact is we do it after reading and understanding what we are supposed to do. Reading in mathematics, saying the word by own mouth, is a very important practice as it helps in the understanding of the terms. Therefore, teachers should develop learners' abilities in reading and interpreting mathematical texts though not as a planned lesson but along with their teaching of mathematics.

2.3.8 Mathematics 'social language'

A mathematics social language is one tool of inquiry used for engaging in discourse analysis. It is a style of language use and ways of speaking in Discourses. What are Discourses?

> "Discourse with a capital "D" are ways of combining and integrating language, actions, interactions, ways of thinking, believing, valuing and using various symbols, tools and objects to enact a recognizable identity, and discourse with a small "d"
>
> (Gee, 2005, pp.21, 26).

In this case an identity of a mathematician is that of being able to reason, justify ideas, argue and evaluate own and others' mathematical work. It is geared towards building a mathematics class into a community of practice where everyone is empowered by understanding the discourse practices. Therefore, Capital "D" is more than language; it is the mathematical terms, mathematical viewpoints, and ways of thinking, classroom exchanges and ways of doing things in the class, in acquiring mathematical concepts. These are some of the very important features influencing the relationship between teaching and learning of mathematics. They include the classroom norms, types and conditions of tasks, teacher instructional habits and dispositions, and learner learning habits and dispositions. For example, what the teacher values most as a better route for her learners to access the terminology she is introducing is what she provides the learners with because she understands the learners attitudes, level of understanding and how they value work given along that route.

Teachers should provide classroom practices which legitimize linguistic practices within the mathematics discipline, for example, if a teacher displays a street-talk in a mathematics classroom she might be considered less favourably within mathematics education Zevenbergen (2000). A street-talk and a mathematics classroom talk are two different talks which will never exchange contexts and be accepted. A mathematics classroom talk values and communicates power and status of those who show characteristics, attributes and dispositions which are desirable within the mathematics community they are in, at the right time (Zevenbergen, 2000). This is what Gee (2005) described as the Discourse with a capital "D". All these attributes and dispositions are accessed through the social language of the small "d", the discourse of the lower case. It is through the knowledge of mathematical terms learners come to posses these characteristics, therefore, the teacher's practices in the defining of these terms hold the key to learner understanding.

In the practice of defining the terms, a social language, small "d", is used in the mathematical communications and conversations taking place as participants work towards reaching for the meanings and understandings of mathematical terms (Gee, 2005). This is the mathematical language which is used to communicate classroom mathematics. The small "d" can then be the language the teacher uses in class to explain the mathematical specialised vocabulary which carries the concept the learners need to access. For example, for the teacher to explain what 'range' is she defines it as the distance which data covers. This gives learners a clue to say if it is the distance their data covers then it means how far the data were spread. Now for them to answer to how far, they need to find the difference between where the data starts and where it ends. In this case the mathematical specialised word 'range' is defined and the learners are made to access the meaning through the discourse of the lower case.

The term 'range' can be familiar to learners but in the case of it being an important word in mathematics it becomes a special term of which the learners need to decipher the specificity of it being a mathematics vocabulary in order to be in line with the teacher's intended Discourse. When the teacher has managed to get learners to understand why 'range' is a mathematics term then she has managed to explain the term that is to split open the terminology of the mathematics register for learners to understand its specialised meaning from everyday meaning (Zevenbergen, 2000; Pimm, 1982). This study was important in finding out what are the teacher's initiations in helping learners decipher and understand the mathematical definition of specialised vocabulary. Therefore, we assume that teacher-talk and teacher's practices are the important ways in developing learners' terminology decoding skills.

Also the semantic structure of a mathematics problem can be considered as small "d", for example, an arithmetic question such as, 'a vendor was selling some tomatoes and a first customer bought 6 of them at R1.50 each, if the vendor was left with 6 tomatoes at the end of the day and her sells were R37.50 how many tomatoes did the vendor had altogether on that day'. The complexity of this question can scare away a greater number of learners and very few might attempt by attending to the word 'altogether' and add 6 tomatoes and 6 tomatoes to get 12 tomatoes as the total number of tomatoes the vendor had in the first place. Here, the learners would have failed to understand that between the 6 tomatoes bought and the 6 tomatoes left, there are a number of tomatoes which were sold to give a total sale of R37.50 which they need to find first and then add to 12 to get the total number of tomatoes the vendor had in the first place. In this case the complexity of the semantics needs the teacher to interpret for learners to understand and access the problem (Zevenbergen, 2000).

Lastly, the small “d” can be the lexical density found in the mathematics register and is denser than that of the ordinary English. Lexical density contributes to the complexity of the mathematics problems and causes a further barrier to learning (Zevenbergen, 2000). Mostly, mathematical terms are precise, they carry the specificity of the meaning themselves without hiring other words that is why they are called scientific registers. Therefore, the teacher’s intervention in explaining these terms is important to convey their precise meanings, because it is in these words that the meaning is found and by teacher’s explanation misconceptions are avoided.

Cuevas (1984) argues that the language used to convey mathematical ideas to learners has become a topic of increased concern to mathematics educators in the United States. And he believes that an inadequate grasp of the language of instruction is a major source of underachievement in school. He advocates a diagnostic approach to teaching mathematics and an incorporation of strategies which deals with the language skills of learners with limited English proficiency in the context of mastering mathematical concepts and skills (Cuevas, 1981 cited in Cuevas, 1984). This is an instructional model where teachers deal with the mathematics content as they deal with second language learner problems at the same time. Teacher’s instructional objective when planning for a multilingual classroom is to help learners understand the terminology and the underlying mathematics, therefore, the teacher should accompany the mathematics content acquisition strategies with terminology access strategies so that learners are advantaged in both.

It is the responsibility of the teacher to help learners access the mathematical terms, literature has shown that access to terminology is enhanced by explaining those terms to learners because each explanation is correctly connected to the characterising property of what is being explained in a sensible way (Groshols and Breger, 2000). Therefore, this study set out to understand how the teachers explain mathematical terms in multilingual classrooms in South Africa by investigating one teacher’s classroom practices in explaining mathematical terms. This will give an opportunity to gain an insight into how mathematical terms are taught to learners for understanding.

2.4 Conclusion

In this chapter, I have presented the study's theoretical perspective; I briefly discussed the Mathematical discourse, the Definition Discourse and the teacher's approach to teaching mathematical terms. I also presented how other writers' findings on explaining terms, relation between mathematics and language, discourse of the classroom and mathematics 'social language' relate to my study in the literature review. Therefore, in the next chapter I discuss the research design and methodology that were used in the study.

Chapter Three
Research Design and Methodology

3.1 Introduction

A suitable research methodology and design had to be adopted in order to investigate a Grade 11 teacher's practices on how she facilitates learners' access to the meaning of mathematical terms in her multilingual classroom. Hence this chapter describes the research design and methodology which was used in the study. The study was designed in respect to the following research questions:

The main question is:

How do teachers facilitate learner access to the meaning of mathematical terms in multilingual classrooms in South Africa?

The critical questions are:

1. How are the mathematical terms explained to learners in multilingual classrooms in South Africa?

2 .What resources does the teacher use to explain mathematical terms?

   a) Which languages does the teacher use to explain the mathematical terms?

   b) What artefacts being used to explain the terms?

3. What Discourse practices are involved in the explanation process of the mathematical terms?

3.2 Research Design

I pursued a qualitative approach which was informed by the exploratory and interpretative nature of the study. Creswell (1994) cited in Leedy (1997) describes a qualitative study as an inquiry process of understanding a social or human problem, based on building a complex holistic picture, formed with words reporting detailed views of the participant and is conducted in a natural setting. It is based on a subjective point of view where the knowledge the study was seeking belongs to the participant, focusing on her own consciousness and thoughts on how to explain the mathematical terms (Opie, 2004). The qualitative method was employed for its quality information seeking on a very small sample of one participant in a particular context, the classroom, (McMillan & Schumacher 1993; Fraenkel & Wallen, 1990). It helped me gain insight into the teacher's perceptions when teaching mathematical terms.

Merriam (1988) asserts that in qualitative research the researcher is the primary instrument for data collection and analysis. She argues that in qualitative research, data are collected by the use of human beings as instruments, instead of through some inanimate inventory or computer. In support, Lincon and Guba (1986) asserts that humans are referred to as instruments for their superior insightfulness, flexibility, responsiveness, the holistic emphasis they can generate, the ability to utilise implied knowledge and their ability to process and assign meaning to data concurrently with their acquisition. Qualitative research focuses on process meaning and understanding (McMillan & Schumacher 1993; Fraenkel & Wallen, 1990).

A qualitative approach, for it being explorative and interpretative, made the researcher a key instrument in the entire process of data collection. This helped the researcher gather information directly and physically from the participant and enabled the researcher to ascribe meaning to some practices in the data analysis using appropriate interpretation according to the researcher's perceptions. It enabled the researcher examine how the teacher handles mathematical terms in the process of teaching and allowed for understanding what the teacher considers as a helpful way of explaining those terms.

3.3 Research Method

It is a classroom-based research and its main purpose is to gain understanding of what constitute teacher's practices in facilitating access to the meanings of mathematical terms by multilingual learners in South Africa. What takes place in the classroom depends on the teacher; how she characterises a mathematical term, the learners' actions and reactions towards the term and its conventional meaning. All these are interrelated, interdependent and open to interpretations. Therefore, the most appropriate research method would be a case study.

According to Opie (2004), a case study is an in-depth study of a single instance, in an enclosed system where certain features of social behaviour or activities in particular settings together with other factors, influence the situation. Cohen, Manon and Morrison (2002) define a case study as a portrayal of what it is like to be in a particular situation with the ability to catch the close-up reality and 'thick-description' of participant's lived experiences of thoughts about and feelings for a situation. Therefore, a case study focuses on real situations to seek greater understanding of the case. It allows researchers to capture evidence of practice and theory of teaching, provides a methodological approach for describing instances of classroom interaction, and allows the origins of every instant and meanings the class seem to hold of the phenomenon under study (Mouseley, 2003). An inquiry is carried out empirically in this research in order to understand and evaluate what is happening in a mathematics class when mathematical terms are being explained. Therefore, I employed a case study to help me investigate a Grade 11 teacher's practices in explaining mathematical terms in her multilingual classroom.

A case study is a method which allows the use of many forms of data collection which includes digital video recording and interviews. It is a systematic, flexible and adaptable way of data collection and it enabled the formulation of some interview questions for the participant which the researcher held after classroom observations (McMillan & Schumacher 1993). It also enabled a thorough data analysis of the phenomenon.

3.4 Methods of Data Collection

The study employed two methods of data collection, a classroom teacher observation being the main method and a semi-structured teacher interview. The method was very appropriate because information was gathered from an empirical setting (the classroom) in its naturalistic state (Opie, 2004; Denscombe, 2007). This method of data collection gave the researcher confidence in the data analysis and the ability to answer the research question.

Two instruments were used to collect and analyze data on how the teacher explained the mathematical terms in a multilingual classroom. The observation data were obtained through a digital video recorder and the teacher interview data through an interview schedule. The two methods which are discussed below helped to obtain rich information and which gave the researcher confidence in reporting the findings (Cohen & Manion, 1980).

3.4.1 Observations

The observation method which was the main data collection method of the study was considered over questionnaires because of its naturalness and by giving the researcher a chance of directly recording what the teacher was doing in her practice (Denscombe, 2007). Although an observation cannot disclose what the participant is thinking, it played an important role in providing more ideas on the information which was needed from the interviewee. I was a non-participant observer in the study (Opie, 2004); therefore, I was fully concentrating on recording the phenomenon in all classroom activities.

Any observation of humans as participants comes with its limitations. An observation may affect the naturalness of the phenomenon under study because the presents of the observer may change the behaviour of the participant (Opie, 2004). To guard against this, five lessons were recorded and only three were analysed. Some limitations were minimised by the use of the video recorder, such as the accuracy recording of when using field notes. The observation was conducted in one Grade 11 class as will be discussed later. As mentioned earlier, observational data were supplemented by interview data as discussed in the next section.

3.4.2 The interview

In search for raw opinions of the participant, the interview was conducted as a follow up on further clarification of some instances where clear understanding of the instances was needed, for example, I wanted to know whether or not the teacher uses formal definitions only and why, in her explanation. Opie (2004, pp.111) asserts that:

> Interviews should encourage the respondents to develop their own ideas, feelings, insights, expectations or attitudes and in so doing allowing the respondents to say what they think and do so with greater richness and spontaneity.

The interview was semi-structured and aimed at getting clarification on areas of interest. Open-ended questions were used to elicit information from the participant. The interview was conducted not only to provide qualitative and in-depth data but also to provide information as to why whatever was happening took place (Opie, 2004). The interview process also helped to get the verbal explanations of the knowledge and understanding the participant had on how to facilitate learner's access to mathematical terms in a multilingual classroom.

A semi-structured interview was used for its flexibility and unpredictable responses which provided rich information when the participant felt free to say what she wanted to because no parameters were laid down. Semi-structured interview offer an opportunity to deviate from pre-arranged text and wording of questions (Opie, 2004). It was also used to draw valid data to avoid the researcher's own perceptions or meanings of participant's intentions.

Although semi-structured interviews often take long time to finish because of their open-ended questions (Opie, 2004) the participant was very clear in her long responses which needed no further probing of information. The participant was very cheerful and attentive throughout the interview hence the rich contribution.

3.4.3 The interview schedule

An interview schedule was developed according to McMillan and Schumacher's (1993) advice that topics and questions should be structured by the interviewer in advance. The questions were formulated in close alignment with the research questions. Opie (2004) also supports this method by advising that the researcher should carefully and thoughtfully translate the research questions into interview questions, but as the questions were open-ended there are times when the interviewer deviated from the scheduled questions.

The seven open-ended questions for the interview were as follows:

1. *What do you consider a better way of introducing mathematical terms to learners in your class?*

This question sought the teacher's perception on different actions and considerations to be taken when introducing or teaching mathematical terms.

2. *Do you use informal knowledge or formal knowledge when introducing or teaching mathematical terms? Why?*

This question sought the teacher's perception on informal knowledge as a resource (or not a resource) in learning mathematics

3. *Looking at the whole topic you are teaching what terms did the learners get straight and what terms did they struggle with? What could be the reason?*

The question needed the teacher to show whether or not the teacher understood her learners' problems in understanding the mathematical terms and how she valued the learners' struggles, how she builds a community-established standard (Davis, 1997) when things are difficult to the participants of the community.

4. *Do you borrow some definitions of the terms from other sources e.g. other textbooks, life situations or other people's definitions (verbal or texts). Why?*

This question was seeking information on whether the teacher uses other sources other than the textbook for mathematical terms' definitions.

5. *What do you consider as a proper definition of the mathematical term when you teach? Why?*

The question was searching for the type of definition the teacher legitimises and emphasises on, e.g. textbook definition or working definition according to the task.

6. *Why were you using the language of instruction (language of mathematics) throughout your teaching?*

The question sought to understand why the teacher was teaching using Mathematical language without switching to any of the African languages in a multilingual class of black African learners only.

7. *What classroom communications do you see effective in making the learners understand mathematical terms?*

This question was seeking the understanding of the discourse practices the teacher employs to enable learner understanding of mathematical terms. Below is the discussion of the instruments used.

3.4.4 Why digital video and tape recorder?

These instruments give a sense of a direct experience with the teacher's instructional activities and talk (Pea, 1999 cited in Schuck & Kearney, 2004). The video recorder gave me an opportunity to observe the teacher's instructional habits and dispositions. When situated strategically, every action the teacher takes in her explanation of the terms is captured. As stated in the methodology of the study, it provided the opportunity to capture teacher's practices in explaining the mathematical terms in a natural setting. It helped me answer critical questions as I observed the practices involved in the explanation process after all these processes were captured. For example, the actions on chalkboard use by the teacher and the learners were captured and the interpretation of them was done later, their appearance at that later stage was still natural with no difference from the day of observation. The digital video recording gave better chances of capturing the teacher's verbal explanations and gestures (non-verbal explanations) such as emotions, facial expressions, body language and pauses (Mousley, 1998 cited in Schuck and Kearney, 2004) which cannot be captured when using an observation form. It can capture these silent features which a researcher can apply as a re-thought on their meaning in relation to the phenomenon and could later correctly interpret them. This is impossible when using an observation form.

Both the instruments are permanent and retrievable record (Plowman, 1999), they gave me an opportunity to get and analyse the data from its naturalistic state far after the data were collected (Denscombe, 2007). Data collected by the use of these instruments are flexible (Plowman, 1999), I could re-wind and re-visit the data whenever I felt that the information I had interpreted did not make sense. There was no need for me to look for an interpreter or search for appropriate meanings in the language-in-use because the teacher taught all her lessons and gave every instruction in English. And because video collected data can be interpreted by many people in different places and still give the same information, it is regarded as holding the holistic indicators of a good research such as trustworthiness and credibility of a research (Opie 2004). The data will be there for a long period of time.

The video footage brought about the language-in-use and teacher's utterances together with other symbolic expressions, for example, when the teacher raised a textbook to show learners the page she was referring to and said to the class, "I mean here not there". This made the data more detailed than if I had collected data using an observation form or a questionnaire which cannot include sign language. The video recorder afforded interpretation of both the utterances and gestures. Its data provided me the means of articulating both what was seen and what was heard at a later time than being forced to articulate immediately when using an observation form. It also allowed me to make validity and biasness checks for trustworthiness before recording and analysing it. I only focused on the information which was relevant to my study and which enabled me answer the research questions.

3.5 The Context

The research was conducted in a school in Johannesburg East, South Africa. It has a spectrum of the major South African lingual groups in that Zulu, Pedi, Xhosa, Sotho and many others including foreign languages are represented. The school was chosen because it had a wider language representation; a class of 25 Grade 11 learners was chosen. It was a multilingual school where all the teachers were English second language speakers. The language of teaching and learning (LoLT) was English and learner-learner communications were in home languages. While the school was not convenient in terms of distance, the interest in it was that I had a colleague who taught mathematics in the school. The school was very accessible and having a good interpersonal working relationship with one of the mathematics teachers, it gave me confidence to go and collect data from the school. Data were collected in the early weeks of second term of the school calendar in a classroom setting.

The context of the class which underwent observation was:

- IsiZulu- 14 learners
- Sepedi- 4 learners
- Sexhosa-3 learners
- Sesotho-3 learners
- Seswati-1 learner

The participant speaks isiZulu which is the language of the larger group of learners.

3.6 Sample Selection and Academic Background of the Participant

The sample consisted of 1 teacher out of 4 mathematics teachers at this school. The teacher was chosen for her qualification and experience. She holds an Advanced Certificate in Education (ACE). One teacher was sufficient because this was a qualitative study which sought an in-depth investigation and analysis of a Definition Discourse as a phenomenon of which valuable and rich insights could be gained (Denscombe, 2007).

3.7 Piloting of the Instruments

A video recorder was used to collect observational data and a tape recorder was used to record teacher interview data. These instruments were found to be very appropriate, for example, video recording helps in checking against bias or misinterpretation though some people may get nagged and feel uncomfortable when videotaped (Opie, 2004).

I undertook a piloting study of the instruments before collecting data to gain the knowledge on how to use them (Opie, 2004). I asked for permission from one teacher's afternoon lesson (not the participant) for piloting. This means that the piloting study was of a different teacher in the same school to identify issues related to the video and the tape recorder. Some of the issues I focused on were audibility, clarity and strategic teacher capturing position. There were no adjustments or further attachments to the camera or tape recorder other than identifying positions in the classroom that could give a good view and audibility of the participant.

I had a partial knowledge about the use of the instruments which needed to be furnished up to avoid unnecessary failures of recording or poor recordings. I needed knowledge on the equipment set up to avoid wasting time (Plowman, 1999) and knowledge on any technical failures which might arise while using them. Opie (2004) argues that instruments bring with them some technical faults such as poor sound. Piloting was very important in that I gained confidence in using the instruments, though they had no problem, an added consideration of using them were their advantages over an observation form or a questionnaire as the next section outlines.

3.8 Validity and Reliability.

Though validity and reliability are important aspects of a quantitative research, Opie (2004) believes that they are not so with regards to qualitative research since it views subjectivity as primary. Therefore, Lincoln and Guba (1986) realising the inappropriateness for a qualitative research they used trustworthiness (credibility, transferability dependability and conformability) instead of validity and reliability

Naturalistic studies require the inquirer (researcher) to draw attention of her audiences on the findings of the study carried out and not leaving himself out (Lincoln & Guba, 1986). For this they argue that researchers must cater, in their studies, for validity and reliability. Reliability of a study gives independent researchers an extension to discover the same phenomena and to have an agreement on the description of the phenomena between researcher and participant (McMillan & Schumacher, 1993). Reliability closely linked to validity is the extent to which the phenomenon is consistent and would give the same result if it could be undertaken again by the use of same instruments with the same participant under the same conditions. While validity of a qualitative study, internally, is the degree to which interpretations and concepts between researcher and participant have the same meaning thus drawing the same conclusions on the data obtained from an instrument (McMillan & Schumacher, 1993; Fraenkel & Wallen, 1990; Lincoln & Guba, 1986). Externally, a qualitative study of a single case cannot be generalised but can extend understandings from the detailed description of results to others and to researchers who will use these understandings in their subsequent researches (McMillan & Schumacher, 1993; Lincoln & Guba, 1986). In other words the validity of the study is in the extent to which the instruments measures what it is supposed to measure or achieve what it is meant to achieve and what is achieved remain reliable. That is to say correct conclusions must be drawn from the use of the same instruments all the time on the same phenomenon and the inquirer should base her confidence on the data collected.

"It is on the basis of the match between the methodology and procedures and research (focus, topic, questions) that the credibility of any findings, conclusions and claims depend, so the importance of getting it right cannot be overemphasised" (Opie, 2004:17). Therefore, I had to make sure that the methodology and procedures I chose suited my research focus, topic and question.

3.8.1 Reliability

As McMillan and Schumacher (1993) argued that reliability in a qualitative study is enabled by the consistency in the interactive style, data recording and analysis and the interpretation of participant's meanings in the data. But this rendered some difficulties as my study was a naturalistic case; the process was more personal than general. The way my participant explained mathematical terms might be different from other researcher's participant on the same phenomenon because different teachers enact differently in their classroom practices. Therefore, observations and interviews findings may also differ (McMillan & Schumacher, 1993). That is why a naturalistic in-depth study cannot be generalised simply because my observations cannot be another researcher's observations on the same phenomenon with a different participant, maybe, unless the participant in my research is observed by a different researcher on the same phenomenon using the same instrument (Lincoln & Guba, 1986). However, the video recorder minimised threats to reliability in that the data captured through this instrument presents the same scenario as it occurred in the classroom.

3.8.2 Validity

Bias is one aspect that impacts on the validity of a research. Bias is defined by Cohen, Manion and Morrison (2002) as overstating or understating the true value or attribute. Identifying sources of bias is a good characteristic of a researcher; from participant's side as well as the researcher's, from the instrument's side as was already discussed earlier and able to control own opinion. Cohen et al. (2002) suggests that the minimization of the amount of bias is the most pragmatic manner to enhance validity. Validity is described as the degree to which a method, a test or a research tool actually measures what it is supposed to measure such that a relationship between claim and results of the data-gathering process can be made (Wellington, 2000).

Validity is the major strength of a qualitative research and very important in data collection and analysis techniques (McMillan & Schumacher, 1993). McMillan and Schumacher (1993; 391) listed some of the techniques in maintaining internal validity as follows:

i) Lengthy data collection period.
ii) Participant's language

iii) Field research
iv) Disciplined subjectivity

3.8.3 How to maintain reliability and validity in my study

As mentioned earlier, the main instrument in a qualitative research is the researcher, as a human being, the researcher may have different academic orientations which can make an instrument to be repeatable. However, I maintained reliability within my study to obtain consistency of my research design.

Interviews were conducted in English which promoted sharing of meanings of the observations between the researcher and the participant and reduced the complexities for the researcher in the writing up of the analysis and report findings. For example, the researcher did not need to decipher the information which was obtained through home languages because English was used throughout data collection. The observation and interviews were conducted in a natural setting, therefore, data were analysed from its naturalistic state even after the day of data collection (Denscombe, 2007). The use of semi-structured interviews in the study allowed for flexibility of both the researcher and the participant giving credit to the validity of the research.

In order to address reliability issues in this research it was critical that accurate descriptions of the processes which were taken were done by ensuring that the data which were collected were that made available by the participant and will subsequently be kept in a safe place for availability to other researchers subject to the approval by the participant. Also the fact that I was not known to the site and to the participant this maximised reliability (McMillan & Schumacher, 1993). In addition I introduced myself to the participant and learnt the classroom culture of the class to be observed very quickly before data collection started as a way to avoid being an unfamiliar person in the process. I was now familiar to the class and behaved like a colleague to the participant throughout data collection.

3.9 Trustworthiness

For a qualitative research to be useful, it has to be credible, transferable dependable and conformable, otherwise it loses its strength through threats to external validity (McMillan &

Schumacher, 1993). This means that a research must give consistent findings and conclusions if it is to be repeated in the similar contexts.

Three aspects of research that might affect validity are:

1. The data gathering tools
2. The researcher's inferences
3. The findings of the inquiry

(McMillan & Schumacher, 1993; Lincoln & Guba, 1986; Opie, 2004)

Below is a description of how effects of the above aspects on validity were minimised.

The data gathering tools

Video recorded data and the audio taped interview data were transcribed word for word in order to strengthen reliability in the interpretation of the transcripts. The observations were verified through interviews with the participant.

The researcher's inferences

My supervisor helped in checking the accuracy of the interpretation of the transcripts and verified the uniform application of the codes. The transcripts were kept separately so that they could be available for scrutiny any time they are needed. The analytical tool developed from the theoretical framework was used to help analyze the data. The categories formed from this analytical tool were used in a standardize way, i.e. descriptions were provide for each category to insure categorisation of the same data by other researchers in the same way. From the supervisor's approval and the researcher's accountability provision of ensuring that the categories were standardized and data were analysed accordingly. In order for this qualitative research to be highly reliable, the researcher recorded possible concrete observational data, for example, what the participant said is what the researcher recorded rather than the researcher's own general sense constructions which would have allowed the researcher's personal perspective to influence the findings.

The findings of the inquiry

As it will be discussed in the next chapter the analysis of the data was done coherently, consistently and systematically, which increased the reliability of the study. The practices from observed data were found relating with the theoretical knowledge the participant gave in the interview, this showed that validity was established. No data where exchanges took place were left untranscribed or unanalyzed.

For this research to be useful and support comparability and translatability the researcher extended the study's understandings by giving detailed descriptions of teacher's practice in the definition discourse so that other researchers can apply them to similar situations (McMillan & Schumacher, 1993). To do this the researcher drew on the two theoretical frameworks by Gee (2005) and Scott, Mortimer and Aguiar (2006).

Credibility can be established by a process called peer debriefing where a researcher exposes him or herself to non interested peers of the study for them to explore aspects of the inquiry (Lincoln & Guba, 1986). This will help the researcher to remain 'honest', to test inquirer's hypotheses and to release the inquirer's emotions and feelings to clear his or her mind for the next steps (Lincoln and Guba, 1986). For this the researcher gave the findings and interpretations of the study to some people to proof read and check for credibility.

3.10 Data Collection

As mentioned before, observations were the main data collection method of the research. Data were collected through five lessons observation of video recorded data and through a semi structured interview of audio taped data.

3.10.1 Observations

A strategic positioning of video installation was assessed for maximum recording of teacher practices before the first lesson of recording had started. A class of 25 Grade 11 learners' five lessons were recorded. This was a purposeful sample where the participant (the teacher), qualified to teach up to Grade 12, taught mathematics for 11 years in this school and is holding an Advanced Certificate in Education in mathematics (FET). It was a purposeful sampling of one participant because the researcher wanted rich information to study in-depth without aspiring to generalise to all such cases (McMillan & Schumacher, 1993). The context and the sample of the study are as discussed in sections given earlier.

Learners sat in groups of 4 and 5 per group facing the chalkboard. The teacher mostly started by asking learners to report back on given group homework. Teacher asks learners to present their group work on the chalkboard. The teacher would ask learners questions, explain on terms and their meaning, she would write on the chalkboard the terms and would ask learners to read from the textbooks and answer questions from the textbooks. The classroom environment the teacher created was welcoming for both learners and the researcher; learners were very free to talk their ideas out in class as the teacher was reachable by all learners.

The teacher called upon some learners or the class to respond to other learners' responses at different instances. I captured most of the teacher's actions in all the lessons including the talk, body movements and expressions and written chalkboard work. My camera was very handy and in good working conditions, I never encountered any problem with the instrument till to the end of the observations. The other part of data collection was a 30 minutes interview after observation recordings were over.

3.10.2 An overview of all the five lessons observed

Classroom exchanges between the teacher and learners in the explanation of statistical terms occurred in Lessons 1 and 2. Lesson 3 was meant for a revision exercise which learners wrote and exchanged their books for marking. In Lesson 4 the teacher gave out past exam question papers for learners to answer certain questions on statistical averages from those papers and some few exchanges took place here. Lastly, Lesson 5 was meant for a test.

Lessons 3 and 5 were not analysed for the fact that no explanation of terms took place as learners were writing a revision exercise and a test respectively. Therefore, three Lessons: 1, 2 and 4 were drawn on after considering the exchanges which took place in them.

3.10.3 The interview

The interview, as was an important part of the data collection process, gave rich data on why what happened and why it happened that way (Opie, 2004). It was used to understand the teacher's beliefs, perceptions and feelings about terminology teaching (Gee, 2005). Seven questions were administered, some were still original and others were changed as a result of what was found in the observations which needed clarification (Opie, 2004). It was a semi-structured interview with seven open-ended questions. The questions were designed to elicit information from the participant on her perspectives in the explanation of the mathematical terms to learners.

3.11 Data Analysis

3.11.1 Analysing data from digital video recordings

Problems which can be encountered by the researcher in video recorded data analysis are that, the researcher may be biased in trying to interpret the data and reliability and validity becomes questionable. In order to analyse digital video recorded data there was a need to identify and select sections in the video clips which contained relevant data to my study (Mousley, 1998 cited in Schuck and Kearney, 2004; Plowman, 1999). Knowing that it is time consuming and difficult to transcribe recorded qualitative data (Opie, 2004), I only transcribed relevant sections which helped me answer the study questions. I carefully handled the data which was one of the priorities to avoid bias in reporting my own interpretations which is very possible when dealing with video recorded data Goldman- Segall (1998). Some video clips were attached to the analysis and in the dissemination of results to achieve fairness.

Body expressions which the participant used to accompany the explanations were documented on a separate sheet to attach the immediate meaning of the expressions to avoid my own different later impressions of the expressions (Plowman, 1999) and were then analysed as part of data collected.

3.11.2 Analysing data from audio tape

Tape recording has its own problems, such as too much data and sometimes its presence puts-off the participant and like the any recording it consumes time when transcribing (Opie, 2004). With this in mind I made sure that the interview questions are short and precise, transcribing became easier for me and because recording stays as natural as was recorded I checked against bias and misinterpretation twice before passing it a true transcription in Appendix B, teacher interview transcript.

3.11.3 The process of data analysis

The study being qualitative made me use qualitative methods to analyse collected data from both the observations and the interview. Hatch (2002:148) indicates that "analysis means organising and interrogating data in ways that allow researchers see patterns, identify themes, discover relationships, develop explanations, make interpretations…". By putting data into codes or themes it enabled me to analyse the data, this means that the participant's information was translated to specific categories for the purpose of analysis (Opie, 2004). Therefore, data were sorted it into manageable units by breaking it into categories in order for it to make sense (Hitchcock and Hughes, 1995). These categories came out from the data set itself, therefore, an inductive analysis was used to analyse it.

An important characteristic of a qualitative research is inductive rather than deductive in that it does not base its information processing mainly on research questions, common sense, personal experience and or theoretical and conceptual frameworks but on the specific elements under study thereafter finding connections among them (Hatch, 2002). This gives an inductive argument which emanates from true pieces of collected evidence pulled together to give a meaningful whole or pattern which can be used to generalise the element being investigated (Hatch, 2002). Because the method involves searching for patterns of meaning in the data, it gave me an opportunity to find a general insight on what the participant valued most in defining mathematical terms in a multilingual class (Hatch, 2002). To enable the finding of the general insight in the participant's practices the data were read and pieces of information from the data were linked, which was then generalised within the study because it is a case study. For example, what was found as an answer to the question: how are the mathematical terms explained to learners?, is expected to be the same for the research participant, explaining the same terms under the same conditions even after the data were collected.

The study's focus was on how the teacher explains mathematical terms in facilitating learners' access to these terms in a multilingual class in South Africa. I scanned through the video clips, while using the critical questions to guide me in identifying where the teacher is explaining or promoting learner access of meanings of mathematical terms so as to answer the main research question: *How do teachers facilitate access to the meaning of mathematical terminology in multilingual classrooms in South Africa?* I then looked for patterns and connections to other aspects important in the explanation of terms (Opie, 2004) such as language-in-use (Adler, 2001), patterns of interaction (Gee, 2005; Scott et al, 2006) or the type of definition being used (Moschkovich, 2003). For example, when the teacher is defining terms is she using conventional formal definitions e.g. the textbook definition?

The video tape observation data and audio tape interview data were transcribed. Open-coding system was used according to the transcriptions. Some codes and categories were formulated from the data itself by carefully considering possible practices the teacher performed in relation to her situation (Hatch, 2002). For example, the time the data were being collected the teacher had already introduced most of the terms, therefore, during data collection the teacher was observed mainly reinforcing learner access to terminology through a procedural way of understanding the terms e.g. teacher asking learners how do they find the lower quartile, line L2: 29 of lesson 2 transcription (see Appendix A). Below I describe the participant and the lessons which were analysed.

3.11.4 The participant

Though the study became successful, it was not easy to conduct it in a foreign country because I had to convince concerned people in the process of acquiring permission to collect data. For example, the intended participant turned down the agreement the day I got to the school of study with the consent forms for him to sign. The reason was not stated and I was left with no other choice except talking to the Head of the Mathematics Department (HOD) to help find a volunteer. The HOD, instead of looking for a volunteer she willingly agreed to be the participant. Her cooperation was more than expected. She was well informed about research procedures and did not hesitate to start within a short period of notice. She signed the forms and the collection of data ensued. This is how data collection process survived and came into being.

The participant was one Grade 11 teacher selected to take part in the study and her selection automated her class to be part of the sample. Her class comprised of only black learners whose first languages were different from the language of learning and teaching as was mentioned in section 3.6. She conducted all her lessons in English though her first language was IsiZulu. She could also speak SiPedi and IsiXhosa but did not use any of these first languages in her teaching.

During the time of data collection the participant was teaching on measures of dispersion or spread, a topic in Data handling. Three out of the five lessons were transcribed (L1, L2 and L4) and analysed.

All the lessons started with a recap of the previous one (see transcript in Appendix A) and as mentioned before in section 3.12.3, the teacher had already introduced most of the Data handling terminology before data collection commenced. Her lessons were classroom textbook oriented and she used a question and answer method most of the time. The teacher would start the move either with a question or will call learners to present their group work on the board, for example, she would ask "who wants to come and do the range for us" line L2: 39 of the lesson 2 transcription (see appendix A). This meant that some learner was to come and show how to calculate the range of the data in question on the board for the class.

After analysing the three lessons and the interview, I then looked for patterns in the teacher's practices, for example, common actions, talks, beliefs, values, tools, recognizable identity and objects (Gee, 2005) which I categorised in a table form as summary categories of analysis to back-up the inductive argument in the findings (see Chapter 6). Because of what emerged in the data an inductive analysis was suitable to analyse it. Next I describe the inductive analysis and the transcription process of the data.

3.11.5 Inductive analysis

Inductive analysis allows for the incorporation of new patterns and categories which may arise during data analysis, therefore, these new patterns and categories which emerged were also analysed, though they were unexpected their inclusion was important (Stake, 1995). For example, the summary categories of analysis were brought forward as a back-up of the inductive argument in the findings. Therefore, I followed the inductive outline model (Hatch, 2002: 162) to analyse my data. The inductive sequential order in the table 3.1 given below was developed from the data and later used for analysis.

Table 3.1: The Inductive Sequential Order of Hatch's (2002) Model

Sequence	Activity
1	I read the data and identified frames of analysis that made sense of what was included in the data. I used these frames to analyse the data. For example, teacher's communicative approaches were divided into two approaches as Communicative approaches 1 and 2 (CA1 or 2), the approaches which the teacher involved learners were identified as CA2.
2	Create domains based on semantic relationships discovered within frames of analysis. For example, developing a set of categories of meaning or domains that reflect relationships represented in the data in terms of a summary.
3	Identify salient domains, assign them a code, and put others aside this is regarded as data reduction, to narrow the focus of my study by reading my categories in my domain analysis and find which domain is salient to the study and link the one which have a relationship, then eliminate single elements.
4	Re-read the data, refining salient domains and keeping a record of where relationships are found in the data. Re-reading the data over and over again is to make sure that the data supporting the domain and all of the included terms within a domain have been identified.
5	Decide if my domains are supported by the data and search in the data for examples that do not fit with or run counter to the relationships in my domains. Here deductive reasoning is mostly used to decide if the hypothetical categories identified hold up. It involves examining the quality of data I have included in constructing my domains.
6	Complete an analysis within domains; this helps me take data analysis to deeper and richer levels as I interpret data by cross examining domains for same qualities or connections among them.
7	Create a master outline expressing relationships within and among domains. Here, a comprehensive representation is created to show how my overall analysis fits together; I put final refinements on analysis and bring closure to the part of the study. This is a guide to write up of the findings.
8	I select data excerpts to support the elements of my outline. Finally, I read the whole data to select or search for examples which I can use in the text of the findings to support the elements that make up my outline. It is important to include data excerpts to support findings in a qualitative report.

3.11.6 Transcription

In this study I found out that data analysis started as from the first classroom observation to the last. I transcribed each observation the day it was recorded into written texts as it was to avoid attaching different meanings of later stage reflection when I would be tempted to give my own general sense constructions which would allowed my personal perspective to influence findings of the study (Mouseley, 2003). I re-visited the data and the transcriptions again later to find if what I had documented still sounded the same or different. I found out that the first transcription remained valid and very few changes were made on areas which had low sound when I finally got the words (Plowman, 1999). Transcribing the data soon after each observation helped me to reduce the labour intensity transcribing has when it is done all at once. I also did not transcribe everything on record; I only selected the sections where the teacher was defining and leading learners to access the meaning of mathematical terms which was the focus of my study (Plowman, 1999). Areas which were not necessary were left out but what was transcribed was taken and numbered continuously without showing a gap in communication.

Documented body expressions and cues on a separate sheet which the participant used to accompany the explanations were integrated in the transcriptions and bracketed as they were important in showing what the teacher valued in her explanations of the terms. For example, L2: 31, the teacher shaking her head disagreeing with what the learners are saying in their explanations of the terms to the class. The body movements were also important in that they showed where the teacher has made it a success in making learners understand the meaning of the term being defined; they showed how much learners were accommodated in the explanation of the terms and how the class was working together as a community. From the theory these body movements are referred to as Grammar Two (Gee, 2005).

I also transcribed some learner talk and actions which were important in completing teacher's intentions in the process of facilitating learner access to terminology, this was necessary for analysis purposes. Where learners used IsiZulu, the researcher transcribed the Zulu words the way they were used and later translated them into English with the help of the supervisor who checked the correctness of this first language translation and its transcription to ensure validity (Opie, 2004). This shows that it was a multilingual class and being a natural setting, therefore, participants had to show this by using their natural language through their natural behaviour of using their first language (Opie, 2004). I maintained consistency in order to produce a truthful account of what was observed (Plowman, 1999). Therefore, proper transcription was ensured in all the transcripts. For example, I made sure that all the words which the teacher uttered were in their original state without changes.

In lessons 1 and 2, the teacher was dominating in the classroom talk, where as in lesson 4 she gave learners work to do in groups and left the class for a meeting. Therefore, lesson 4's transcription did not take so much time to transcribe (see Appendix A). Table A shows the symbols which were used to construct some areas of the transcriptions.

The transcripts were refined as a way to minimise unnecessary repetitions of some instructional utterances, some simple mistakes and poor English constructions were corrected without changing the intended speaker's meaning because it was not the grammar which mattered but how learners' terminology access was facilitated by the teacher. All this was cautiously done by viewing and listening to the video tapes twice while checking against the already made transcripts. Though the teacher interview transcriptions were easily done they were also checked twice to make sure they contained only the main ideas of the participant with no interpretations to attain a primary descriptive validity (Maxwell, 1992).

Tables were used to show consistency of certain categories, quotes were used as back-up in the presentation of results so as to bring life to the findings of the study (Opie, 2004), and the meaning of the data was reached "through direct interpretations of the individual instances and through aggregation of instances" (Stake, 1995, pp.74). Hence the interpretations were originated from the language in the lesson and the interview transcripts (Maxwell, 1992) and interview data were used to substantiate observed data for credibility and trustworthiness of the study (Opie, 2004; Maxwell, 1992) and this was maintained in the data analysis.

In my analytical framework I chose only two categories form the main constructs of the theoretical framework and the research questions, the discourse 'd' which I identified as a tool for communication in the Definition Discourse (Gee, 2005) and in the communication approaches (Scott et al., 2006). The focus of this study was on the teacher's practices in facilitating learner access to mathematical terminology, it was important to define and identify teacher's levels of response and types of definition she legitimised. Therefore, in the next chapter is the description of the analytical framework and its flow chart which was used to analyse teacher's practices in this study.

3.12 Ethical Considerations.

McMillan and Schumacher (1993) maintain that it is imperative for researchers to obtain permission to enter any particular field and also ensure the confidentiality and anonymity of the participants, thus encouraging the latter's free choice of participation. This required a full description to the participant of how the data were to be collected and be used by the researcher. The following ethical guidelines were, therefore, pursued in order to get permission.

Permission was sought from the Human Research Ethics Committee (Non-Medical) Wits University for clearance of research involving human subjects and the school concerned. Prior to data collection, the participant was given an oral explanation and a written outline of an information sheet stating the research project's aims and data collection methods. In order for the teacher not to artificially perform the practices (Merriam, 1988) the aim of the study was explained and assurance of confidentiality of the study was given. This was to make the participant feel comfortable with the observation process in order to collect data based on naturalistic practices (Opie, 2004; McMillan & Schumacher, 1993). The information sheet stressed that participation was voluntary and details were to be anonymous. Permission was also sought to video record the participant's practices. The participant was assured that pseudonyms would be used for the school and the participant both in the lesson and interview data to ensure anonymity. Therefore, the participant remained the 'teacher' in the transcripts and participant in the main document.

Researchers do have the freedom to investigate, ask questions, give and receive information, to express ideas and criticise others' ideas and freedom to publish findings, but must have respect for the truth and for people (Bassey, 2003; Opie, 2004). They should not jeopardize themselves and their careers, and should have in mind that, they owe truthfulness in data collection, analysis and reporting of findings to both the participants and themselves. Therefore, the researcher had an understanding that the data belonged to the participant; hence, the participant was treated with dignity and afforded privacy (Bassey, 2003). Also a promise was made to the participant that apart from describing and interpreting officially collected data related to participant's classroom practices in the explanation of mathematical terms no unrelated data will be analysed and that after the report has been written and submitted collected data will be destroyed after three years. Effort was made to observe time as per agreement in the classroom observations and more specifically in the interview.

It was neither a 'rape research' nor a covert research or researcher's qualification award intention (Opie, 2004); therefore, after data collection I showed my appreciation by extending a word of gratitude to the participant. In addition apart from obtaining a qualification, the results can be presented in educational conferences and they can be shown to the facilitators of this study and the participant.

3.13 Conclusion

This chapter have described the research designs of the study. The justifications of the research methods and instruments used, the sample selection and the context were also presented. How the study holds trustworthiness and the ethics that guided the collection of data were explained. Also in this chapter data analysis procedure and justification of analysed data are given, and data transcription process explained.

Chapter Four
Analytical Framework

4.1 Introduction

This chapter presents the broad analytical framework of the study. The relationships of frames of analysis were discovered; categories with salient domains to the study were identified and linked as shown below (Hatch, 2002). As discussed above, I used the theoretical framework, the research questions and what emerged from the data itself to develop this analytical framework. The possible teacher's practices are categorised and presented in two sequences, communicative approach 1 (CA1) and communicative approach 2 (CA2). The teacher can either follow the CA1 or the CA2 and cannot perform both because they seem to work independent from each other in the Definition Discourse.

The codes used to analyse data were formulated from this broad analytical framework. The codes were then defined later in the study. Below is the broad analytical framework of the study.

Table 4.1: The Broad Analytical Framework

Construct	Description /Definition	Why this construct	Identification of the construct/indicator	Guiding questions to identifying the construct
Definition Discourse **(DD)**	That part of the teaching where the process of explanation of mathematical terms takes place.	It will help to understand this aspect of the classroom practice, some of which include: 1. understanding how the teacher defines mathematical terms 2. understanding the way in which the teacher facilitates learners' access to mathematical terms 3. knowing how sources of definitions are accessed by learners 4. knowing the resources used to help learners understand a definition.	1. Seating arrangement (teacher and learners consistent positioning, e.g. in groups, all facing the chalkboard, etc.) 2. Languages used (for teaching, explaining, questioning, etc) 3. Teaching method (exposition, discussion, question and answer, group work, etc) 4. Teaching strategies, e.g. use of dictionary definitions, writing terms on the board and let learners come up with definitions, repeating textbook definitions, reading textbook definitions and unpacking them for learners, etc	1. What are the consistent practices of the classroom during definition of terms? 2. What languages are used when terms are defined? 3. What are the usual sources of meaning does the teacher use? 4. What strategies does the teacher use to teach the definitions?

Discourse with the small "d"	Language-in-use, the language used in class during definition of terms.	1. To identify the languages used to disseminate meanings of mathematical terms, and understand how language-in-use helps multilingual learners to access mathematical terms. This understanding will help to explain when and why the languages were used.	1. Language used, English, Zulu, Tswana, etc 2. Use of more than one language 3. Use of two or more languages in one utterance 4. Use of mathematical language 5. use of informal language	1. Does the teacher code switch? 2. What is the language-in-use? 3. When does the teacher use other languages other than language of mathematics? 4. Does the teacher use Mathematical Language? 5. What are the foreseen reasons the teacher using other languages? 6. Does the teacher allow the use of other languages?
Communicative approach (CA)	Teacher's non-interactive or interactive practices when defining mathematical terms.	Communication approach is a powerful entity in teaching. Teaching and learning is a communicative process, which means that, when the teacher is explaining mathematical terms she is communicating information about the definitions of those terms to learners, therefore, it is important to understand: 1. the teacher's approaches e.g. the interactions the teacher approves. 2. how the teacher presents new ideas and terminologies in her explanation 3. the teacher's ways of communicating the terms e.g. writing the term on the board or presenting the term verbally.	1 Explanation by the teacher 2. Involvement of learners in the definition of terms 3. Questioning style of the teacher 4. Approaches used in the definition of terms 5. Learner involvement strategies	1. What forms of interaction does the teacher use with a. the whole class? b. groups? c. individuals? 2. When are interactive discourses such as: a. Authoritative interactive and non-interactive b. Dialogic interactive and non-interactive used ? 3. Which of the following

				communications seem to occur often in the classroom: a. The teacher writing term on the board b. The teacher verbalises the term c. The teacher considering learners' ideas, contributions d. The teacher is main source of meanings of mathematical terms e. The use of the board in her explanations when explaining terms f. The teacher summarises and revisits learners' point of views g. The teacher presents and focus on one specific point of view - by leading learners though question and answer h. Writing learners' ideas on the board i. Re-voicing learners' responses? j. Encouraging learner-learner interactions

Intertextuality (I)	Bringing in other texts' meaning or other people's definitions	Sometimes teachers need to quote other people's definitions of terms to reinforce learner understanding or to help them explain the terms to learners, therefore, it is important know other sources of information that used in the definition of mathematical terms.	1. Text from other sources, e. g. examples, borrowed terms from other subjects, ideas from newspapers and magazines, quotes from other books, etc.	1. Does the teacher use other material other than the textbook for the definition or for explanations? 2. Is the teacher using (quoting) other people's verbal explanations or ideas to explain the terms?
Grammar 2 (G2)	Using different expressions and body gestures to emphases key points.	Normally when describing something or even singing people are seen adding actions of emphasis to portray the importance of some information, likewise, the teacher accompanies her explanation of terms with body movements or some expressions as she emphasises on important key points, therefore, I need: 1. To understand when and why does the teacher uses expressions	1. Signs used 2. Gestures used	1. What actions does the teacher use to explain mathematical terms?

4.2 The Definition Discourse

The Definition Discourse (DD) is the overall practice that includes the small 'd'. Therefore, it encompasses discourse of the small 'd', types and sources of definition the learners are required to understand, teacher's communicative approaches in the explanation of the terms and forms of classroom interaction that the teacher use.

4.2.1 The small 'd'

In this study, the small discourse ('d') is used as a tool for communication in the big 'D' Discourse, the DD. It is used to communicate the definitions of the terms. The small 'd' is the language the teacher uses in the DD, it could be the mathematical language (ML) (see section 2.4.8), code switching (CS) or the ordinary language (OL). ML is identified as the language of the textbook when defining mathematical terms, for example, when 'range' is defined as 'the difference between the maximum and the minimum observed values of the dataset'; this is regarded as a mathematical language and also as a textbook definition of 'range' approved in the classroom. While OL is identified as the language used without strong and precise mathematical vocabulary in it, for example, when 'range' is defined as 'the distance between the lowest point and the highest point' the statement becomes so ordinary that it can be of any other discipline than the mathematics discipline. Such definitions do not engage the participants in mathematics conversations; as the participants cannot talk the talk of the mathematicians, they seem not to think, value, see, act or believe like what the mathematicians do, therefore, it is hard to identify their talk within the Mathematics Discourse (Gee, 2005).

From my experience as a teacher the ML helps the teacher to lead learners to conventional definitions of terms because the textbooks she uses in class are written in that language. But for a multilingual class, it is the teacher's choice of language that best suits her learners in order for them to understand the mathematical language used in the textbook and the types of definitions she chooses to teach. Below I discuss the types of definitions and the definitions which the Definition Discourse contains.

4.2.2 Types of definitions

I then link the small discourse to the types and sources of possible definitions the teacher might use. These definitions are the formal conventional definitions which are the textbook **descriptive** definition (TDD), the textbook **procedural** definition (TPD) and the **dictionary** definition (DD). The sources of such definitions, from my experience as a teacher of mathematics, are the mathematics textbooks which might be used in the classroom and/or the dictionary. The teacher, therefore, uses the discourse of the small 'd' to define them to learners.

Though, Moschkovich (2003) outlines four types of definitions, **formal**, **dictionary**, **stipulative** and **working** definitions. The mostly practiced definitions in mathematics classrooms are the formal definitions discussed above. The stipulative and working definitions are those which a class can formulate through discussion and agrees upon using them. I have referred to such definitions as **contextual definitions** because they have been developed to suit people in a certain situation working on a certain activity. Moschkovich described them as shared definitions. The formal and the dictionary definitions are those given by a text (Moschkovich, 2003) and these are the ones the teacher is expected to be using because the two, are conventional. I have split Moschkovich's formal definitions to textbook **descriptive** definition and textbook **procedural** definition so as to have three, instead of two conventional definitions.

The textbook **descriptive** type of definition is when the term's mathematical meaning is expressed in words in the form of mathematical statements explaining the word, for example, the term 'range' can be described as 'the difference between the maximum and the minimum observed values of a dataset'. Here the statement is explaining what 'range' is and not how the range of the data is found, and an example of a question calling for such a descriptive definition could be: how do we define 'range'. While the textbook **procedural** definition is when the mathematical meaning of the term is understood through finding or calculating the range of the dataset, for example, in the data (45, 35, 70, 65. 73, 87, 69) range is 87-35 = 52. Therefore, 52 is the range.

In a calculational or procedural way of defining terms, symbols (as above) and/or words can be used in order for learners to access the mathematical meaning of the term. Here an example of a calculational definition in words is, ‘range’ is the highest minus the lowest score of the data, in other words, which is what is to be done in order for us to get the range of the dataset. For this, a procedural question a teacher might ask is: how do we find ‘range’.

If learners lack procedural fluency and/or conceptual understanding when it comes to reasoning and arguing out their thinking (Mukucha, 2009) they can fail to carry out solution procedures or give an answer. Therefore, if the teacher is using the two types of definitions, she is reinforcing learners’ access to terminology because she is making learners understand the terms through their mathematical descriptive statements and through the procedural undertakings the term might be indentified with.

The teacher facilitates learners’ access to the definition of the term ‘range' through how it is calculated, and the results they get from calculating is what range is. The procedural way of defining terms, from my experience, is found to be the most common way teachers use to define most mathematical terms and it could count as a reasonable way of explaining mathematical terms. Though both are textbook definitions, the difference between the two is that, the descriptive type tells a scientific story and the procedural type demonstrates how to obtain what the term stands for. A scientific story is not easily forgotten for it brings with it the relation of the term to its descriptors, hence, relational understanding of the term by the learners (Skemp, 1976). While procedural demonstration helps learners understand underlying mathematical principles in the terminology i.e. understanding the meaning procedurally (Ball, 1990).

From the types of definitions described in this section, the textbook descriptive and procedural are the types of definitions the teacher is expected to use in the Definition Discourse as she facilitates learners’ access to mathematical terminology. She then has to use certain communicating approaches to reach for learners’ understanding of these definitions; therefore, next I look at the communicative approaches which the teacher may use.

4.2.3 Communication approaches of the Definition Discourse

In the mathematics classroom, the teacher needs to communicate the information to be learnt to learners, and to do so the teacher needs to have a way of approach. In explaining mathematical terms in the Definition Discourse, it is important for the teacher to put in place a communication approach she is going to use in facilitating learners' access to terminology. Scott et al. (2006) discussed 'Authoritative Discourse' and 'Dialogic Discourse' as ways of interactions which take place in a mathematics classroom and in this study I discuss these interactions in two communicative approaches.

4.2.4 The Communicative Approaches in the explanation of mathematical terms

There are two communicative approaches which can be used by the teacher when defining terms. These are:

The communicative approach 1 (CA1) and

The communicative approach 2 (CA2),

The CA1

In the CA1 the teacher uses exposition method to define the terms while learners listen without contributing in the explanation of the terms. The teacher introduces and presents through describing what is to be learnt i.e. describing the new term (IDNT) and does not expect learners to respond (Lobato et al., 2005). Here the mathematical terms are taught in such a way that the teacher does not interact with the learners. I have referred this to a non-interactive authoritative presentation (NIAP) where the teacher tells definitions to the learners without them contributing in defining those terms. For example, the teacher writes the terms and their definitions on the board and tells learners to read from the board and/or copy into their books. Learners are only listening to the teacher's talk without them contributing their own ideas in the process. Therefore, CA1 is a non-interactive dimension in which two categories where learners do not take part in classroom talks, the non-interactive/authoritative (NIA) and the non-interactive/dialogic (NID) (Scott et al. 2006) are situated. In NIA the teacher gives the terms and the definitions on the chalkboard, no learner participation, in NID the teacher tells or read the term and the definition from a textbook to the learners also no learner participation.

4.2.5 Classroom non-interactive dimension

All the categories described in the CA1 above are teacher-centred, teacher-telling and do not consider learners' contributions in defining the terms, therefore, they take up a classroom non-interactive dimension of defining terms. One of the teacher's reasons for teacher-telling could be that the teacher has a predetermined definition of the term and only her definition is correct, therefore, learners must take the definitions exactly the way she wants them to be understood. This is a result of teacher's evaluative understanding of her learners. I have described such understanding as an evaluative response level 1 (ER1) to learners' level of understanding. In this case learners are given ready-made products of learning which leads to poor retention of knowledge because spoon-fed type of knowledge is easily forgotten and is regarded as rote learning (Skemp, 1987). CA1 has its advantages and disadvantages. Some of the advantages of using the CA1 are that:

- The teacher gives precisely the definition she wants the learners to learn
- The outcome of the lesson is always to teacher's expectation or always known by the teacher
- It saves time
- The class is completely under teacher's control and
- The teacher can present a lot of terms in one lesson

While some of the disadvantages are:

- It provides learners with rote learning
- Learners are not developed in logical thinking, creative thinking or self-confidence.
- Learners are made victims of their learning instead of them having a right to learn.

This CA1 dimension contradicts with that of the CA2.

The CA2

Although in the CA2 the teacher also leads learners to predetermined definitions, learners are involved in the process of defining terms. In this, the teacher can initiate by providing information about the new term (IPINT) which learners can use as they participate in the definition of the terms (Lobato et al., 2005). For example, when defining the term 'range' the teacher can ask learners to identify the maximum value and the minimum value of the dataset, thereafter leave learners to grapple with that information or hints to work out their way to the term's definition.

The teacher introduces and presents her work in an interactive way with learners. I have referred this to an interactive authoritative presentation (IAP) where the teacher may be leading learners to predetermined conventional definitions through an interactive/authoritative (IA) approach. In this type of interaction, learners are involved in the process of explaining the terms and are observed taking part in the classroom talks. An example here can be that the teacher writes the term on the board or verbally presents it to the learners and uses a question and answer method which invites learners to take part in the explanation of the terms. For example, a question like ‘who can define range’ shows that the teacher is intending to get learner responses, thus inviting learners to a classroom talk. But it is to the teacher’s discretion as to how she conducts the classroom talks after an authoritative presentation. A teacher needs to have, as part of classroom management, some form of interaction to conduct lessons through in order to control the classroom talks. Some of the advantages of CA2 are:

- Teacher allows learners take part in their learning and it deepens their understanding
- A conducive environment is created for learning to take place and the class becomes a community of mathematics teaching and learning.
- Learners are free to talk their thinking and to ask questions
- Knowledge taught through this approach has higher retention

While the disadvantages could be:

- Time consuming, one term can be taught/learnt in the whole lesson
- Noisy class
- Intensive lesson planning

But in both CA1 and CA2 the teacher’s authority is there because the teacher needs to present the mathematical terms to be learnt and learners are there to receive what the teacher presents. The teacher’s presentation can be, for example, by writing the terms on the board for every learner to see how they are spelt as she pronounces them. This bringing learners’ attention to what they are supposed to focus on, because learners learn effectively by seeing (Graber, 1990). From these two communicative approaches, CA1 and CA2, terminology is presented but what is different is that CA1 does not consider learners’ contributions; therefore, it does not accommodate classroom interactive talks, the CIT.

The CIT

In this study the classroom interactive talks are only identified with the CA2 because they cannot take place in CA1 where the teacher is the only one talking. I have identified the CA2 approach with the classroom interactive talks (CIT) meaning forms of interaction taking place in the class which Scott et al. (2006) call patterns of interactions. In the CIT the teacher's authority still reigns, leading learners to predetermined definitions and presenting the lesson in a learner welcoming way of involving them in the process of defining terms. In this study the CIT is broken down into analytical usefulness of the categories CIT1, CIT2, CIT3, CIT4 and CIT5. For example, the teacher may choose to use a teacher whole-class form of interaction to conduct her lessons, this is categorised CIT2. This form gives equal chances to all learners in class to talk their ideas. The CIT1, CIT2, CIT3, CIT4 and CIT5 categories are explained later in the study.

The CIT can take place in different patterns among them are teacher-learner, teacher-whole class, teacher-groups, group-class, learner-learner and learner-teacher-learner. For, example, in a group situation, the teacher may ask learners to develop an explanation of the term in their group and report back to the class, thus initiating a learner-learner exchange in groups and group-class exchange when the group reports back.

Considering teacher's initiation in the CIT, learners respond and their responses might build onto exchanges between the teacher and the learners and these are defined as classroom meaning making processes in the CIT. In these exchanges, the teacher considers learners' different point of views and builds on them, for example, by asking probing questions which lead learners to access the meaning of the terms. Scott et al. (2006) says that such teacher-learner interactions happen in an initiation-response-evaluation (I-R-E) pattern. An example here could be that, after the teacher has written the term on the board a learner may define it correctly or wrongly and the teacher responds to this as feedback starting a conversation between teacher and learners. The exchanges may continue as classroom talks and these are what I have called classroom interactive talks and the teacher may use any suitable language in the discussions to reach for learner understanding. Therefore, CA2 is classified as a classroom interactive dimension as discussed below.

4.2.6 Classroom interactive dimension

The CA2 is a classroom interactive dimension because it is comprised of two sub-categories of interactive dimensions, the interactive/authoritative (IA) and the interactive/dialogic (ID) (Scott et al., 2006). The ID is where the teacher writes the term or verbalise it and leaves it to the class for explorations or negotiations of working definitions of the term. In the ID, the teacher takes a position of a facilitator who then agrees with the learners on working or situational definitions while in the IA type of interaction the teacher socialises learners through question and answer to predetermined definitions. In the IA, the teacher, instead of facilitating takes a different position of a leader who establishes and consolidates a point she is teaching. Examples of teacher socializing learners to predetermined definitions are when the teacher uses the textbook in the process of explaining the terms or when the teacher asks learners questions which invite them to participate in the definition of terms, for example, questions like 'who can define range for us?, how do we define range?' Such questions show that the teacher is expecting some contributions from learners and when she responds to the learners' contributions interactions ensue. Next I discuss teacher's response in the definition of terms.

4.2.7 The teacher's response

Looking at the communicative approaches discussed above, it is certain that always there is a dimension taking place in the mathematics classroom, it could be interactive or non-interactive but in both, learners receive some learning. Form my experience as a teacher, when an initiation by the teacher has been made there always is a follow up from the teacher's side to what learners ought to say or do. Teacher's initiation has been dealt with in the IAP and the NIAP teacher presentations, now what follow are the teacher's types of response in defining the terms.

When an initiation is given, what follows are responses to it. The response of the learner is not very important in this analysis, what is very important is the teacher's response to learners' responses. The teacher's response is important in that it directs learners to where she wants them to go i.e. taking learners through a process of defining terms and it also gives learners feedback to their thinking, i.e. developing learners' understanding of the term or concept she is teaching. The response of the teacher depends on how she listens to the learners' contributions. Davis (1997) discusses three forms of listening: evaluative listening, interpretive listening and hermeneutical listening. By listening evaluatively, the teacher might be looking for a predetermined definition and does not consider learners' definitions or ideas of the term; in listening interpretively, the teacher opens up for classroom talks and socialises learners to meaning making of the term and does not impose her way to learners instead she leads learners to specific definitions; while listening hermeneutically, the teacher and the learners work on working and situational definitions of the terms (Davis, 1997).

According to this study, the type of response the teacher will give depends on how the teacher listens to learners' contributions. Therefore, I referred the types of listening to types of response: evaluative listening to evaluative response (ER), interpretive listening to interpretive response (IR) and hermeneutical listening to hermeneutical response (HR).

In the evaluative response (ER) the teacher has a predetermined definition of the term, only her way of defining the term is correct and does not allow learners' contributions or ideas, therefore, she tells the definitions. For example, the teacher tells the definitions and learners write in their books. The interpretive response (IR) is where the teacher incorporates learners' contributions and ideas about the definition of the term. The teacher gets a partial definition, probes, re-voices or paraphrases towards a predetermined definition of the term. For example, the teacher re-moulds learners' utterance in her feedback response to correct the given definition. She gives learners time to think and grapple with the term's definition and she asks for justifications of ideas. In the hermeneutical response (HR) the teacher introduces the term to the class, takes a position of a facilitator and joins the learners in the exploration of the definition without having a predetermined definition for the term. In this later response the teacher agrees with the learners on working or situational definitions, while in the former two responses the teacher goes by the predetermined definitions. Below, are levels attached to teacher's responses and these levels are determined by the dimension of talk the teacher chose to employ in the class.

There are four levels of response, two of them from the interpretive response. The levels were used to rate and categorise teacher's responses and they also determine the dimension of talk which took place in the classroom. These levels also determine whether the teacher facilitated learners' access to terminology with understanding or not. Below are the levels describing teacher's responses and how they could be identified, followed by the tables showing defined practices of each main category. In some main category indicator codes were attached to the defined practices in alphabetical order, which were then used to analyse the data. Lastly, is a coded flow chart which summarises the main categories of the analytical framework of the study, though it does not show codes of the defined practices.

4.2.8 Levels of Response

Level 1 (ER1) – the teacher defines the term herself without learner contributions, for example, the teacher writes the term and its definition on the board for learners to copy down. At this level rote learning of definitions is taking place, they might be procedural or descriptive but learners are just receiving the knowledge without participating in its construction (Skemp, 1987).

Level 2 (IR2) – the teacher writes terms on the board or verbalise it; gets a partial procedural definition, therefore, she continue with probing questions, re-voices or paraphrases it, while writing learners' ideas on the board; gives chance to all learners to define it to the class and/or gives the predetermined definition if learners do not give it clearly or correctly. At this level procedural definitions and explanations are given.

Level 3 (IR3) – the teacher writes terms on the board or verbalise it; gets a partial descriptive definition, prods learners to come up with the correct description of the definition; re-moulds learners' descriptions; if the definition is correct she asks for justifications, explanations or examples assessing learners' understanding and elaborates further by emphasising on the correct definition; gives associated definitions, concepts or terms and differences in meanings where necessary. At this level descriptive definitions and explanations are given.

Level 4 (HR4) – the teacher writes terms on the board or verbalise it, leaves it to the class to grapple with its definition, the teacher does not have a predetermined definition, she puts the term to the floor so that the class work on the definition according to their situation and come up with an agreed definition. The teacher takes a position of a facilitator in the exploration of definitions. At this level situational and working definitions and explanations are given. Below are some tables and a chart flow showing defined codes which were used to analyse the data.

4.3 The tables showing Defined Practices of each main category

Table 4.2: Types of Definitions

Type of definition	**Definition**	**Indicator**
Textbook **descriptive** definition (TDD)	Formal conventional definition described in words in form of mathematical statements explaining the mathematical meaning of the word (term).	The teacher: • Asks questions which lead to a descriptive definition e.g. how do we define 'range'? **DQ** • Explains the term in a descriptive way according to the textbook but not in a calculational way. **DE** • Reads a descriptive definition from the textbook **RDD**
Dictionary definition (D)	Formal conventional definitions of terms from a dictionary	The teacher: • reads or refers to the dictionary for the definition
Textbook **procedural** definition (TPD)	Formal conventional definition describing a calculational way of finding the mathematical meaning of the term. Symbols and/or words can be used here.	The teacher: • Uses or accepts a formula **F** • Uses textbook procedural definitions e.g. teacher reads a mean worked example or calculates mean as she explains the term and tells learners this is what is meant by the word 'mean' of the data **RPD** • Asks learners textbook procedural questions e.g. 'How do we find 'range'? How do we calculate 'mean'? **PQ**
Stipulative definition (SD)	Contextual or situational definitions of the term according to the class' context.	The teacher: • Does not use the formal conventional textbook definitions, but facilitates in the negotiations of the class' suitable definitions of terms according to the situation they are facing
Working definition (WD)	Definitions which are easy to work with and easy to understand.	The teacher: • Does not use the formal conventional textbook definitions, but leads learners in the formulation of class' working definitions of the terms, which are easy for the class to work with. • Uses definitions which are suitable for the class' understanding of the term

Table 4.3: Authoritative Presentation

Authoritative Presentation	Definition	Indicator
Non-interactive Authoritative Presentation (NIAP)	Introducing or presenting the terms in a non-interactive way, interaction with learners is not practiced.	The teacher: • Writes the terms and their definitions on the board and tells learners to read from the board and/or copy into their books • Reads the definitions from a book while learners listen • Explains or describes the terms to the learners without learner input (telling session) while learners write the definitions. • Uses 'self' (telling), does not promote class discussions
Interactive Authoritative Presentation (IAP)	Leading learners to predetermined conventional definitions and learners are involved in the process of explaining the definition.	The teacher: • Acknowledges learners' contributions **AC** • Uses artefacts in the explanation of the terms. **Art** • Allows idea blurting out behaviour if not called **BB** • Tells learners to write in their books and insists on a certain way of presenting work in the learners' work books **BWRT** • Uses a clean chalkboard **CB** • Class control **CC** • Uses class discussion strategy **CDS** • Calls out learner's name to respond/talk **CL** • Checks learners' work **CLW** • Uses or accepts different sources of definitions. **DS** • Encourages learners to read about terms **ER** • Stands in front of the class **FC** • Allows learners to discuss/talk with each other and other people. **FI** • Uses formal knowledge **FK** • Uses group sitting arrangement facing the board **GSB** • Uses group work strategy of teaching. **GWS**

		• Gives home work and tasks for the subsequent lesson's preparation **HW** • Asks learners to justify their ideas **IJ** • Uses informal knowledge **IK** • Gives instructions to learners **IL** • Leaves incomplete statements for learners to complete **INCS** • Allows learners to use the board in the explanation of terms. **LCB** • Uses language of mathematics in explanation of terms. **ML** • Accepts non-mathematical language **NML** • Assesses learners' prior knowledge. **PK** • Uses question and answer strategy **QAS** • Recaps previous knowledge. **RK** • Sums-up class discussions, corrects learners' definitions and gives the predetermined definition **SD** • Uses a classroom textbook as a source of definitions in the process of explaining terms **STB** • Accepts unison response **UR** • Verbalises the term. **VT** • Uses whole-class facing the board. **WCS** • Writes the term on the board **WTB**
Classroom Interactive Talk (CIT)	Forms of interaction taking place in the classroom.	The teacher: • Interacting with groups **CIT1** • Interacting with the whole class **CIT2** • Interacting with individuals **CIT3** Learner(s): • Interacting with each other **CIT4** • Interacting with the class **CIT5** • Leading the teacher **CIT6**

Table 4.4: Forms of Initiation in the Communication

Initiation	Definition	Indicator
Initiating by describing a new term (IDNT)	Teacher uses exposition method to define the terms while learners listen without their contributions	The teacher: • Explains or describes the terms to the learners without learner input (telling session) while learners write the definitions.
Initiation by providing information about new term (IPINT)	The teacher provides learners with useful information about the term which learners can use to define the term	The teacher: • Uses artefacts in the explanation of the terms **Art** Gives hints, clues, associated with the terms. **HC** • Uses leading questions which can help learners to define the term. **LQ**

Table 4.5: Integrated Classroom Teacher Talk

Communicative approach	Integrated Classroom Teacher Talk	Definition	Indicator
Communicative approach 1 (CA1)	Non-interactive/authoritative (NIA)	Giving the terms and the definitions, no learner idea.	The teacher: • Writes the terms and their definitions on the board and tells learners to read from the board and/or copy into their books
	Non-interactive/dialogic (NID)	Telling the term and the definition or reading from a book to the learners, no learner contribution	The teacher: • Reads the definitions from a book while learners listen and write notes (dictating) • Explains or describes the terms to the learners without learner input (telling session) while learners write the definitions.
Communicative approach 2 (CA2)	Interactive/authoritative (IA)	Introducing or presenting the terms in an interactive way with the teacher's lead, interaction with learners is practiced.	The teacher: • Builds on learners' response to define the term **BR** • Considers learners' ideas and contributions **CI**

			• Uses expressions **E** • Uses gestures in the process of explaining the terms. **G** • Encourages group discussions **GD** • Gives hints and clues **HC** • Allows long exchanges focusing on one term, phrase or a particular group of words at a time. **LE** • Leads learners in the process of defining terms **LL** • Uses leading questions which can help learners to define the term. **LQ** • Paraphrases learners' responses or ideas **PP** • Asks questions for learners to respond. **QR** • Uses learners' responses to ask further questions. **RFQ** • Revisits responses or ideas. **R** • Refers to chalkboard work **RCW** • Re-voices learners' responses or ideas **RV** • Uses the textbook in the process of explaining terms **TB** • Writes learners' ideas on the board **WLI**
	Interactive/dialogic (ID)	The teacher writes the term or verbalise it and leaves it to the class for explorations or negotiations of working definitions of the term. The teacher takes a position of a facilitator.	The teacher: • Writes the term on the board or gives it orally to learners to define. • Joins the class in the exploration and negotiation of the definitions without leading learners to a specific definition for the term. • Facilitates the discussions towards working or situational definitions

Table 4.6: Forms of Response

Response	Definition	Indicator
Evaluative response (ER1)	The teacher has a predetermined definition of the term, only her way of defining the term is correct and does not allow learners' ideas, therefore, she tells the definition.	The teacher: • Orally describes the definition of the term to the learners. • Writes the term and its definition on the board • Does not involve learners in the definition of the terms she tells them the definitions
Interpretive response (IR2)	The teacher gets a partial procedural definition, probes, re-voices or paraphrases it. The teacher has a predetermined definition of the term.	The teacher: • Adds some explanation to learners' definitions. **AE** • Gives the conventional definition if learners fail to give it. **CD** • Gives procedural explanation **PE** • Prods learners using questions which lead to a predetermined definition. **PLQ** • Asks learners procedural questions **PQ** • Gets procedural response **PR**
Interpretive response (IR3)	The teacher gets a partial descriptive definition from learners and asks for explanations or examples i.e. assessing learners' understanding, adds some explanations. The teacher has a predetermined definition of the term.	The teacher: • Gives descriptive explanation **DE** • Differentiates meanings of terms and of those with more than one meaning and stresses on the one she wants learners to learn. **DM** • Asks learners descriptive questions **DQ** • Gets a descriptive response **DR** • Asks learners to justify their definitions or give examples **IJ** • Prods learners towards a predetermined definition. **PLQ** • Re-moulds learners' definitions towards a predetermined definition.

		RMD
Hermeneutical response (HR4)	The teacher act as a facilitator as she joins the learners in the dialogue exploring the definition without having a predetermined definition for the term, therefore, she agrees with working or situational definition.	• The teacher introduces the term by writing it on the board, leaves it to the class to grapple with its definition • The teacher takes a position of a facilitator and as a class formulates working or situational definitions and the teacher agrees on that. • The teacher does not have a predetermined definition for the term.

The flow chart below summarises the above discussed main categories of the analytical framework. The main category indicators are the coded practices which were used to analyse the data of the study.

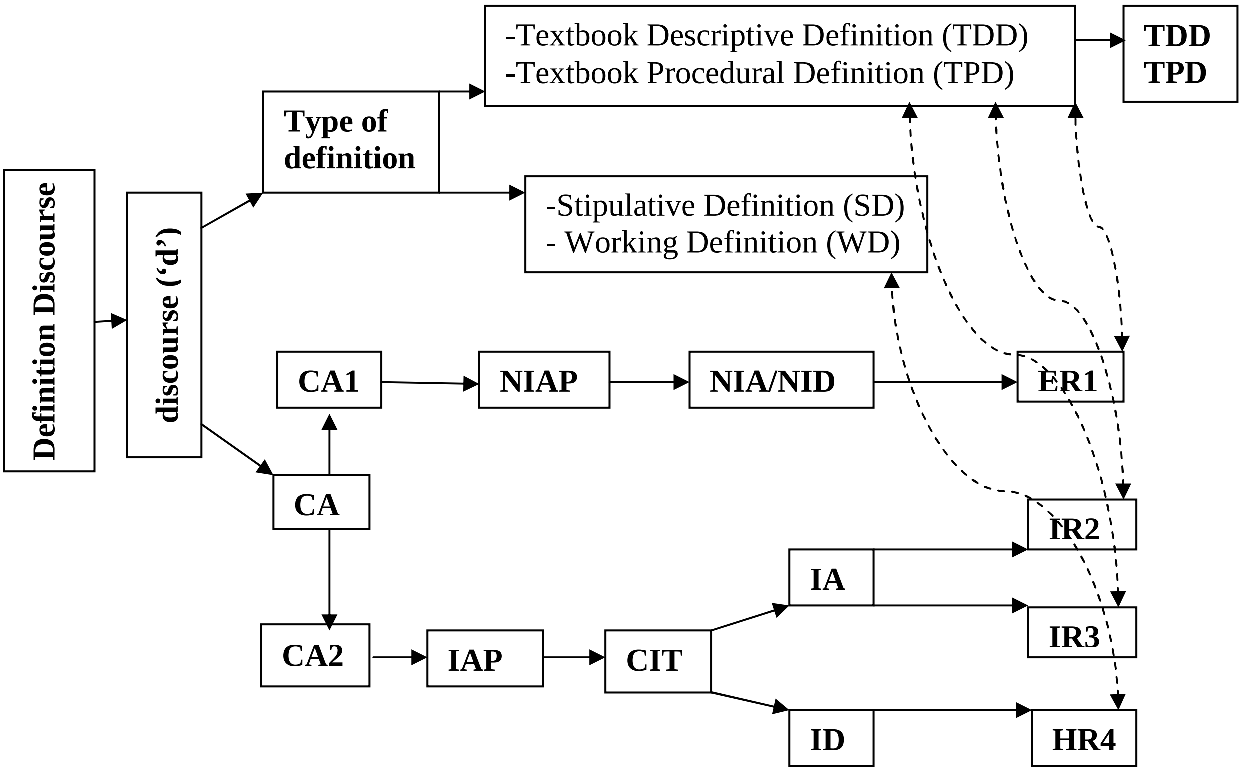

Figure 4.1: The main category code flow chart of the study's analytical framework

4.4 Conclusion

This chapter presented the broad analytical framework of the study suitable for a qualitative research according to Hatch (2002). It also discussed the Definition Discourse and what it entails. The Definition Discourse practises were categorised and defined and lastly the flow chart was provided and explained.

Opie (2004, pp.31) reminds us as researchers to be prepared to own our work and says "the most immediate and obvious way of doing so is to say 'I' ". This was sparingly done throughout the study.

In the next chapter I present data analysis and the results of the study.

Chapter Five

Data Analysis and Presentation of Results

5.1 Introduction

This chapter presents the analysis of the data and the results. The data illuminates the teacher's position as that; it is not enough in the introduction of the term for the multilingual learners to get access to the meaning of terminology but in the longevity of deliberations and engagement with the term. The data collected were analysed to find an answer to the main research question:

- How do teachers facilitate learner access to the meaning of mathematical terms in multilingual classrooms in South Africa?

I analysed three lessons from the observed data, Lessons 1, 2 and 4, and the teacher interview data. I chose to analyse the three lessons because it is where the participant was present in the lessons, and where more informative data about the teacher's practices in facilitating learners' access to terminology was obtained. The chapter presents four sections of data analysis:

i) The Classroom Discourse.
ii) The participant's communicative approaches to teaching terminology for learner access and understanding.
iii) The participant's legitimised definitions and their sources.
iv) The classroom interactions and language-in-use.

In all the above sections, codes were used to link the data to the questions as discussed in this chapter.

The first section of the analysis deals with the teacher's approaches and these approaches were scrutinised for categorical patterns which appeared in the results. In other words, it deals with the teacher's practices she engages with in her approaches. For example, I looked for matching categories of the teacher's practices in the observed data so as to identify a pattern in the teacher's classroom approaches i.e. whether the pattern was CA1 categories or CA2 categories (see Figure 4.1). The interview helped me to get an insight into the teacher's verbal explanations of the knowledge and understanding she has on how to facilitate learners' access to mathematical terms in a multilingual classroom as shown in the coded teacher interview transcript (see Appendix D).

5.2 The Process of Data Analysis

Data analysis took place within the sequential series developed from the data according to the inductive model (Hatch, 2002). Hatch's inductive data analysis is a qualitative method, which was used to analyse the data as discussed in Chapter 3.

The coding of transcripts included, among other things, identifying communicative approaches, integrated classroom talk, teacher responses and types of definitions. These codes were formed from the categories which were created from discourse practices discussed in the theoretical framework and also from the data itself (Hatch, 2002) (see Appendix F). Therefore, these were the codes used to link the data to the critical research questions of the study.

The focus of the investigation was on the teacher's practices in facilitating learners' access to mathematics terminology. Therefore, I viewed the video clips to establish every instant the teacher was talking. I connected these instances to each other (Opie, 2004) in a way to find factors which can be attributed to teacher's practices in the explanation of mathematical terms. The teacher's communicational approaches to learners' cognitive development, language-in-use, class environment and other discourse practises were identified in the transcripts (see Appendix C). In other words, the ways of combining and integrating language, actions, interactions and learners' ways of thinking (Gee, 2005) which the teacher was using to facilitate learner access to terminology were analysed (see Appendix E). I then used the analysed data to answer the critical research questions.

The first critical research question that guided the study is:

1. How are the mathematical terms explained to learners in multilingual classrooms in South Africa?

To answer this question I was looking for the teacher's practices which were intended to reach for learners' understanding of the mathematical terms. Because most of the terms had already been introduced before the study investigations had started, I then focused on how the teacher reached for learner understanding of those terms after their introduction. While, for terminology introduction, I relied mostly on the interview questions as a source of information as to how the teacher introduced the terms. The second research question is as follows:

2. What resources does the teacher use to explain mathematical terms?

a) Which languages does the teacher use to explain the mathematical terms?

The intention of using the question was to identify the resources and tools that the teacher was using in the explanation of the terms and interaction with the learners in facilitating their access to mathematical terminology.

b) What artefacts being used to explain the terms?

This question was to help list the kinds of artefacts the teacher used, if any, to help learners understand the terms and the way she conducted her lessons. The last question is stated below as:

3. What Discourse practices are involved in the explanation process of the mathematical terms?

This was a very important question because it was looking for the Discourse practices, types of definitions, and the communication approaches the teacher was using. Therefore, the teacher's actions and talk were analysed in the three lessons and her responses to interview questions to find out how these led to the learners accessing the mathematical terminology.

The data are presented in the following sections as the results of the study, and in these sections, pseudonyms were used for both the teacher and the learners. The teacher's pseudonym is Ms Tulane. The selection of excerpts was based on the codes, for example, UR was used to look for unison responses across all the three lessons and analyse them at once to avoid repetition of discussing the same code if lessons were analysed individually.

Section I

5.3 Classroom Discourse

According to Gee (2005), classroom Discourse includes ways with words, deeds and interactions, thoughts and feelings, tools and objects, times and places of happening that allow the teacher and the learners to enact and identify different socially situated identities in the classroom. Mathematics has its own classroom Discourse. It takes an iterative and interactive process in which teachers engage learners in conversation about mathematical ideas at various cognitive levels through talking, asking questions, demonstrating and writing. It is where support for developing one's thinking, through the usage of language in the teacher questioning, learner answering and idea sharing with others (Cobb, & Bauersfeld, 1995) takes place. It enables the connection of learners' own everyday language with the specialized language of mathematics, mathematical terminology. It is where feelings about teaching and learning mathematics are portrayed and values enacted through classroom interactions. These interactions, for example, can be teacher-learner, where the teacher approaches teaching through an authoritative communication which may give platform to dialogic communication (Scott et al, 2006) hence promoting individual reflection through oral or written documents.

The classroom Discourse comprises classroom articulations which Scott et al (2006) referred to as patterns of the *initiation-response-evaluation* (I-R-E) in the teacher's explanation of mathematical terms for learner access to terminology. To analyse the classroom Discourse, the following were considered: classroom sitting arrangement, classroom discipline, teacher's standing position in the class, chalk board use and classroom interaction. The transcripts and the interview data were analysed to find out the classroom Discourse. The findings about the classroom Discourse are shown below and the symbols used in the transcriptions are given in Table A below.

Table A: Types of symbols used in the transcriptions

Symbol	Definition
[]	An expression or body action which the speaker took
{}	Translation from Zulu to English
L1, L2, L4	Lesson names
...	Interruptions from another speaker or continuation of text(s)
(...)	Inaudible
(-)	Pause

5.3.1 Before the lesson introduction

Before Ms Tulane introduced her lessons, she expected certain things to be in place, as shown in the excerpts below.

<u>*Excerpt 1*</u>

L1: 1 Teacher: [When the teacher and I entered the classroom, most learners were making noise, and those who were not seated ran to take their places, some learner went and rubbed the board and came back to join the others. The teacher walked and learners were seen putting away some non-mathematical items e.g. books, and sat quietly in groups facing the board waiting for the teacher's opening instruction of the lesson. The teacher went in front far right and spoke]. *I gave you some data to go and study, and you were working in groups so each group should tell us what they did, ok. What did you find from the work I gave you?*

...

L2: 1 Teacher: [The class monitor had collected and handed out learners' marked group work just before the lesson had started. Therefore, when we entered the classroom the noise which the learners were making was that of discussing their marked work, but as we entered the classroom the learners greeted us and the few who were still standing quietly got seated in their usual places. The teacher stood, this time, in front far left and talked to the learners]. *Which group can present the stem and leaf of the data from previous work, Thabo*

...

L4:1 Teacher: [We entered the classroom, this time learners were seated talking to each other but their voices were lowered. The teacher greeted the learners and ordered them to pull out their group past exam question papers and asked them to answer certain questions on statistical averages from those papers]. *I want you to continue answering those questions from the exam papers, and then each group will present a solution of a question to the class. Stop concentrating on your book, we all have eeh question papers, this is one of the typical exam questions, I want you to answer them after you have discussed with people in your group, I will be back after twenty five minutes, okay*

From the excerpts above, Ms Tulane expected:

- Learners to be seated in their usual discussion groups
- Learners to be disciplined
- The chalkboard to be clean before she starts giving instructions

The excerpt shows that Ms Tulane makes sure that all learners are quiet, seated in their groups facing the chalkboard, and the chalkboard is clean before she starts the lesson. Cleaning the chalkboard before the lesson starts suggest a norm and a practice the teacher has put in place. After a clear and quiet settlement of the learners, Ms Tulane walked in front to start the lessons. In all the lessons, Ms Tulane took the front position of the class to address learners. This showed that the teacher needed to control the class; therefore, she took a position where she could be seen and heard by every learner and able to see every learner when conducting the lesson.

The teacher's classroom seating arrangement is in groups and there is teacher-group interaction as a teaching strategy which seems to create and engage learners in a sound pattern of interaction when explaining mathematical terms (Scott et al., 2006). Addressing learners in groups occurred in all the lessons implying that the *classroom interactive talk 1* (CIT1) was taking place in this class (see Appendix C and E; Table 4.3). In the interview data, the teacher indicated that those groups were permanent and group work interactions were more beneficial in her teaching (see 5.4.1 Section II below).

5.3.2 Introduction to the lessons

An introduction of every instructional situation is very important: it is the one that determines the importance of what is to be learnt, it tells of the teacher's beliefs and values (Gee, 2005), the teacher's knowledge about her learners and it also helps the teacher to take control of her classroom. Ms Tulane's introductions of the three lessons above showed that she addressed learners in groups. Below are the teacher's first utterances in the three lessons which indicate how she addressed the groups.

<u>Excerpt 2</u>

L1:1 Teacher: I gave you some data to go and study …and you were working in groups so each group should tell us what they did, ok. What did you find from the work I gave you?

...

L2: 1 Teacher: Which group can present the stem and leaf of the data from previous work, Thabo

...

L4:1 Teacher: I want you to continue answering those questions from the exam papers, and then each group will present a solution of a question to the class. Stop concentrating on your book, we all have eeh question papers, this is one of the typical exam questions, I want you to answer them after you have discussed with people in your group, I will be back after twenty five minutes, okay

What the above excerpts indicate is that, in Lesson 1, Ms Tulane gave learners some work to go and study in groups implying that learners were expected to *work in groups* (GD) and the work was given as homework implying that learners are given *homework* (HW) which she then used to introduce the new lesson. Also from the excerpt Ms Tulane used previously given work in Lessons 1 and 2 implying that *prior knowledge* (PK) were used to introduce the lessons. Also implied is that the teacher *recaps knowledge* (RK) from previous work when introducing a lesson. This too was indicated in the interview by the teacher as shown in the excerpts below.

<u>Excerpt 3</u>

IQ1: What do you consider as a better way of introducing mathematical terms to learners in your class?

P-R1: to assess where the learners are at first, what they already know about what I want to teach them…things like their prior knowledge, I recap what I had taught them to lead to what I want to teach…what I have noticed with my learners is that when… I first asked the learners to bring their last term's marks from 13 exercises (PK, RK and HW)

…

IQ:7 What classroom communications do you see effective in making the learners understand mathematical terms?

P-R7: I find group work and report back working well for me, as you just saw in most lessons, because even if I would have explained the definition… learners need to discuss on their own and with this they share their understandings and they do that using their languages… (GD)

5.3.3 The lesson

Ms Tulane incorporated different communicative approaches to reach for learners' conceptual understanding of the terms she was teaching. These include: how she initiated the communication, her authoritative presentation, the forms of interaction she maintained in class, forms and levels of response she used and, types and sources of definitions she used. Section II below, presents what Ms Tulane believes should be done when explaining the mathematical terms in a multilingual class.

Section II

5.4 Communicative Approaches in the Teaching of Mathematical Terms

In the process of teaching and learning, communication is very important. More importantly, are the ways of approach to the process.

The teaching and learning process observed was part of a sequence of lessons in defining basic concepts of statistical averages and were organised around the topic - averages of dispersion. In this topic, Ms Tulane was defining terms on averages of dispersion which included terms like range, mean, median and quartiles. Therefore, there was a need to analyse the teacher's *communicative approaches* (CA) used in the process. Below are the discussed communicative approaches the observed teacher used in the lessons.

5.4.1 The group work strategy

Ms Tulane did not just arrange learners in groups; she used group work as a teaching strategy. Most of her work was done in groups; this includes class work and class discussions. Learners would do individual work when it comes to particular exercises which the teacher needed for individual performance. Most questions or instructions to learners were intended for the groups in which individual group members would answer for the group. The excerpt below shows questions and instructions intended for groups:

Excerpt 4

L1:1 Teacher: …and you were working in groups so each group should tell us what they did, ok.

L1:2 Learner: The range

...

L1:34 Teacher: there it says... in your groups

L1:35 Class: Lowest score

L1:36 Teacher: Right, I want you in your groups (...) on the data; find the range and the five number…

L1:37 Class: Summary

…

L1:69 Teacher: are you working as a whole group

L1:70 Learner: Yes

L1:71 Teacher: you are not working in a group, you must discuss as a group,

L1:72 Joy: Number in between

L1:75 Teacher: or we want sixty seven and sixty two, right let's discuss in groups, two minutes

...

L2:1 Teacher: Which group can present the stem and leaf of

L2:2 Thabo: [Goes to the chalk board, draws a stem and leaf on the board, writes an incorrect spelling of the word 'stem' and the class corrects him], *ngu number bani lapha* {what is the number here}

…

L2:53 Teacher: which group?

L2:54 Stella: Us

L2:55 Teacher: Which group, you, right okay let's look at what Brenda has drawn there

L2:56 Class: Summary

L2:63 Teacher: next group, they are fine, you are also fine

L2:64 Class: Yes

L2:73 Teacher: in your groups

L2:74 Sam: It is here
...
L4:1 Teacher: I want you to continue answering those questions from the exam papers, and then each group will present a solution of a question to the class.

L4:2 Class: Yes

L4:3 Teacher: Are you discussing with your group? [Leaving the class for a meeting]

L4:4 Class Yes

The above excerpt shows that the teacher was interacting with groups. This suggests that the teacher was using a group work teaching strategy in the explanation of mathematical terms. This is so because the teacher gave learners class work, homework and report back work in groups. The teacher also involved learners in the explanation. The class used ordinary, non-mathematical and mathematical languages to interact, suggesting the inter-change of these languages by the class was the intention to cater for multilingualism in class. A teacher-group interaction dominated in all the three lessons (as shown by the excerpts), a pattern of interaction which seemed to be an already established pattern. Therefore, Ms Tulane, as an OBE trained teacher, found group work strategy effective after putting it into practice and made it a permanent strategy as she pointed it out in the interview shown below.

Excerpt 5

IQ4: Do you borrow some definitions of the terms from other sources e.g. other textbooks, life situations or other people's definitions (verbal or texts). Why?

P-R4: I find group work and report back working well for me...
…
IQ7: What classroom communications do you see effective in making the learners understand mathematical terms?

P-R7: I send them in their groups, and these are permanent groups in that class, Sometimes the group members would seem to give individual ideas to the teacher's questions but Ms Tulane would maintain groups' shared knowledge by reminding learners to work in groups as shown in the excerpts above. For example, when the teacher found that the answer given by a group member was not correct she would want to know if it was a group shared idea by asking questions or giving comments such as: *"are you working as a whole group; you are not working in a group; you must discuss as a group; are you discussing with your group?"* lines L: 69, L1:71 and L4:3 in Excerpt 4 above.

This strategy took place in the CIT1 form of interaction where the teacher was interacting with the permanent groups in her class. The teacher used the CIT1 approach which allowed learners to respond to teacher's talk as groups and the teacher to respond to groups' responses as feedback. This CIT1 is in the category *communicative Approach 2* (CA2) in which the teacher can choose to approach the class as in groups, as a whole without particularising a group or an individual learner (see Table 4.3).

5.4.2 Chalk and talk strategy

The teacher and the learners used the chalk board to write down important points that came up during the lesson. From the lessons observations, writing the term to be defined on the board seemed less important, instead most terms explained in this class were verbalised either by the learner or by the teacher. For example, 'range', the first term to be explained in Lesson 1 was verbalised by a learner answering to teacher's first question of the lesson. The teacher then wrote the term on the board after the learner had verbalised it. It shows that, sometimes Ms Tulane used learners' contributions to bring to surface the terms she wanted to teach about, and as learners' contributed she wrote those contributions on the chalkboard, as shown in the excerpt below.

<u>*Excerpt 6*</u>

> *L1:5 Teacher: Okay let's just write it even though, because that's what he has learned about* [writes the term 'range' on the board], *saying the range, how do you define the range, what is the range*
>
> *L1:6 Class: Highest score minus lowest score*

L1:7 Teacher: Ok, I will separate whatever you give me, tell me whether it falls under the five number summary

L1:8 Joy: No idea

...

L1:20 Teacher: Q2 or M, This one [pointing at M on the board]

L1:21 Class: Yes

...

L1:49. Teacher: Right, what is your range here, right people can we just summarise here, what is the range [going back to the board]

L1:50. Class: Forty eight

L1:51 Teacher: Forty eight, people did we arrange from the highest to the lowest, yes or no

L1:52. Class: No

L1:53. T: No, because you will be wasting your time, look (...) find the highest score, find the lowest score and (...) move on, now number 2, we have the range there, what is the highest score there

L1:54. Class: Eighty two

L1:55. T: Eighty two minus the lowest...

...

L2:2 Thabo: [Goes to the chalk board, draws a stem and leaf on the board, writes an incorrect spelling of the word 'stem' and the class corrects him],

L2:3 Class: Kunye, kubili, kubili {one, two two}

...

L2:39 Teacher: Who wants to come and do the range for us, Joe

L2:40 Joe: because it is the highest number that is given here [pointing at the board]

L2:47 Teacher: What was there [pointing at the data on the board], *are you listening*

L2:49 Teacher: Ooh you have done everything, right, now people any problems with other questions, did you encounter any?

L2:51 Teacher: who wants to come and draw it, can we have someone who wants to come and draw a box and whiskers who wants to come and draw the box and whiskers,

L2:52 Lerato: Try [goes to the board and draws a box and whiskers]

L2:57 Teacher: right, so people try and draw it but now people what we should do ne {ok} eeh try and use a scale

...
L2:61 Teacher: did you see what I did there? [Pointing to the board]

L2:62 Nicole: No

Writing learners' ideas on the chalkboard provides the class an opportunity to monitor its talk's direction and its thinking (Franke et al., 2009). Therefore, the terms were verbalised and also written on the chalkboard.

When Ms Tulane orchestrated classroom conversations by the use of questions the term would be on the board. She wrote on the board what the learners had to say with respect to the term in question mainly for the learners to see what they are saying and as they verbalise their ideas, the teacher wanted them to listen to their thinking about the term too. Therefore, Ms Tulane wrote learners' contributions about the term on the chalkboard as shown in the excerpt above, example, lines L1:6 and L1:7 of Lesson1.

As it was a very interactive class, Ms Tulane sometimes allowed learners themselves to write on the chalkboard especially when they could not verbalise their ideas e.g. lines L2:2 and L2:52. And in turn, some chalkboard work was used as reference work when there was a need this is evidence in lines L1:20, L2:40 and L2:47, she would then summarise the ideas to bring learners to correct definitions in order for them to understand and move on, line L1:49. This shows that Ms Tulane would involve the learners first in the discussion i.e. incorporate learners in the explanation of the terms towards predetermined definitions. Therefore, the teacher did not define the terms to the learners instead she considered learners' ideas about the term in the explanation. This chalkboard use is evident in the Excerpt 6 above and also in the interview excerpt below.

<u>*Excerpt 7*</u>

IQ1: What do you consider as a better way of introducing mathematical terms to learners in your class?

P-R1: …what they think the mathematical term I want to teach mean after saying and writing the term on the board I write a mathematical term on the board which is not familiar to them if it needs a diagram for me to illustrate the term I draw it *and But sometimes when I write something on the board which they do have a clue about it.*

…

IQ2: Do you use informal knowledge or formal knowledge when introducing or teaching mathematical terms and why would you use it

P-R2: when they show that what I have written on the board is known to them I assume it's informal

…

IQ7: What classroom communications do you see effective in making the learners understand mathematical terms?

P-R7: I ask them to read from the textbook and explain to the class their understanding of the terms…then I finalise by explaining the term according to the textbook we are using in class. But normally I write the term on the board

Excerpts 6 and 7 suggest that the chalkboard use and the teacher-learner talk were important in the explanation of the mathematical term.

This strategy is in the CA2 category and was carried out through the CIT1 and *classroom interactive talk 2* (CIT2) patterns of interaction. The CIT2 pattern is where the teacher addresses the learners as a whole without particularising a group or an individual learner (see Appendix C and E; Table 4.3). The teacher used the word 'people' to mean the class not the groups as in lines L1:51, L2:49 and L2:57 in the Excerpt 6 above. Therefore, in this strategy two forms of interactions were used.

5.4.3 Question and answer strategy

The question and answer strategy was one of the practices of the classroom. The strategy entailed the teacher asking learners questions and learners responding to the teacher. The teacher also followed up learner responses with probing questions as shown in the excerpt below.

Excerpt 8

L1:5 Teacher: ...saying the range, how do you define the range, what is the range

L1:6 Class: Highest score minus lowest score

...

L1:22 Teacher: Which is the median, what is the median?

L1:23 Learner: The number that divides...that divides the data into two parts, right [asking if he was right]

...

L1:43 Teacher: Who (...) okay what is the range, can you define range, if not yet understood

L1:44 Class: Yes [nodding their heads in agreement of not getting the definition right]

L1:45 Teacher: Quickly calculate it

L1:47 Teacher: What is the range here, what is the range?

L1:48 Learner: It's forty five

L1:53 Teacher: ...we have the range there, what is the highest score there

L1:54 Class: Eighty two

...

L2:8 Teacher: How many scores are there?

L2:9 Class: Twenty four

L2:29 Teacher: How do you find the lower quartile tell us

L2:30 Joy: I jumped this number, then I got to [points at 3 in between 33 and 34 in row three]

L2:41 Teacher: Brenda what is the range?

L2:42 Brenda: L2:42 Brenda

The above excerpt shows a question and answer pattern that the teacher was using in the explanation of terms. I called it a question and answer strategy because the teacher taught by means of questions. She used question and answer as a teaching strategy to interact with the groups in the definition of the mathematical terms. Also the high frequency of questions and learners' responses shows that it was one of the teaching strategies the teacher used in her highly interactive class.

Ms Tulane allowed learners to respond to her questions as they took part in the defining process of mathematical terms, therefore, most questions the teacher asked, learners responded to. She focused on one definition until it was understood by the learners. This was done by allowing long exchanges about one term (see Appendix A), hence building on learners' responses to define the terms (Powell, Francisco & Maher, 2003) while leading them through a process of explaining those terms, this was evident from the teacher interview extracts below.

<u>*Excerpt 9*</u>

IQ1: What do you consider as a better way of introducing mathematical terms to learners in your class?

P-R1: I normally ask them questions relating to what I want to introduce I just switch to questions of wanting to know what they know about that...

...

IQ2: Do you use informal knowledge or formal knowledge when introducing or teaching mathematical terms and why would you use it?

P-R2: I will ask them some questions…

…

IQ7: What classroom communications do you see effective in making the learners understand mathematical terms?

P-R7: ...and ask questions, and when they give some responses...

The interview suggests that the teacher used this strategy to facilitate access to meaning of the mathematical terms. This strategy did not occur in Lesson 4 because there was no explanation of terms taking place instead learners were now applying and using the knowledge they had gained from the explanation of the mathematical terms to answer the question papers (see Appendix A).

The teaching strategies discussed above allowed the teacher to interact with the learners implying that learners were involved in the definition of terms. Therefore, they are learner involvement strategies. The communication which occurred during the lesson as the teacher used these strategies is discussed below. Firstly I looked at the types of questions the teacher used during the lessons.

Types and use of questions in the lesson

Ms Tulane used a wide variety of question types. Her questions ranged from those eliciting factual information to those seeking explanations. The questions on facts, which I will refer to as *procedural questions* (PQ) because they required information on mathematical procedures, mainly comprised the *What, When, How,* and *Who* questions. Examples include questions such as: “*How do you find the lower quartile tell us? What is the range here, what is the range?*” and “*How many scores are there?*” Ms Tulane also asked evaluative questions which sought the learners’ ideas, which normally began with words like: *Is, Did, What is* and *Do,* for example, “*is the range part of the five number summary?*” She also used relational and explanatory questions which ask for the relationship between facts, and the meanings and explanations of facts, respectively. These were categorised as *descriptive questions* (DQ) and they are found in the *What, How* and *Why.* The DQs are those which ask for formal conventional definitions described in words in form of mathematical statements explaining the mathematical meaning of the word or the term. For example, the questions “*how did you define the median, what does middle mean? Q1 what is Q1, the first quartile and the minimum value, are they the same?*” and “*why is it the mean not the median?*” would call for either relationships or explanations of terms. The excerpts below shows some of the different questions the teacher asked, Excerpt 10 are the procedural questions and Excerpt 11 are the descriptive question.

<u>*Excerpt 10*</u>

L1:75 Teacher: what is the median and give me your answer

L1:76 Joy: No
…
L2:8 Teacher: How many scores are there?

L2:9 Class: Twenty four
L2:19 Teacher: how do you find the lower quartile?

L2:20 Joy: I divided the positive two by two…

L2:29 Teacher: How do you find the lower quartile tell us

L2:30 Joy: I jumped this number, then I got to [points at 3 in between 33 and 34 in row three]

L2:39 Teacher: Who wants to come and do the range for us?

L2:40 Joe: Yes, [coming to the board] *the range, I find the highest number, for this one the range will be (...)*

L2:41 Teacher: Brenda what is the range

L2:42 Brenda: Forty six

L2:43 Teacher: And what is the inter quartile… [Disagreeing with Brenda’s answer]

L2:44 Brenda: Range

L2:91 Teacher: Ja {yes} have you found the median

L2:92 Joy: Yes

L2:119 Teacher: how did you calculate the mean?

L2:120 Mike: No

L2:121 Teacher: so how must you calculate the mean

L2:122 Mike: You must use this formula which is x bar is equal to

In the above excerpt, the teacher was asking questions which called for *procedural responses* (PR) either in symbol form or in words describing the calculational way of finding the term’s value, and this implies that the teacher was using PQs in the definition of the mathematical terms through what Essien (2011) referred to as a procedural Discourse. PQs occurred in Lessons 1 and 2 only implying that it is where terms were being explained, and the frequency of the questions in both the lessons seemed to be high and balancing implying that the teacher used the PQs to facilitate learners’ access to mathematical terminology while interacting with them in groups. Also depicted is a highly interactive class.

<u>Excerpt 11</u>

L1:5 Teacher: saying the range, how do you define the range, what is the range

L1:6 Class: Highest score minus lowest score

L1:10 Teacher: Three, why three and not...

L1:11 Nicho: Quartile, it’s the lower quartile which is the median of the first half

L1:22 Teacher: Which is the median, what is the median, who can define for us?

L1:23 Learner: The number that divides that divides the data into two parts, right [asking if he was right]

L1:24 Teacher: Right, it is the middle value of that data when the data were arranged in order of size, right,

L1:43 Teacher: Who (...) okay what is the range, can you define range, if not yet understood

L1:44 Class: Yes [nodding their heads in agreement of not getting the definition right]

L1:45 Teacher: Quickly calculate it

L1:46 Learner: Fifty two... the range

...

L1:71 Teacher: how did you define the median, what does middle mean

L1:72 Joy: Number in between

L1:75 Teacher: Q1 what is Q1, the first quartile and the minimum value, are they the same

L1:76 Joy: No

L1:77 Teacher: what is the difference between first quartile and minimum value, third quartile and maximum value?

L1:78 Joy: Q2

...

L2:117 Teacher: The mean not the median, this is the mean, why is it the mean not the median

L2:118 Mike: Yes, it is the mean because it is from the formula

The above excerpt shows that the teacher was asking questions which needed learners to express their ideas about the definitions in words in the form of mathematical statements explaining the term. This implies that the teacher also used DQs in the facilitation of learners' access to terminology. The DQs call for descriptive conceptual explanations. Setati (2005b) referred to this as a conceptual Discourse, where mathematical concepts are discussed or described, and therefore, the teacher was asking descriptive questions in order to get *descriptive explanations* (QE) for the terms. Essien (2011) argues that descriptive explanations are conceptual explanations, as they promote conceptual understanding of the mathematical terms in learners; hence relational understanding of those terms (Skemp, 1976).

The descriptive questions were in Lessons 1 and 2 implying that the lessons were crucial for explaining mathematical terms. The teacher asked learners questions which called for responses implying that the teacher meant to involve learners in the explanation of terms by using questions which would make learners respond.

It was observed that not all descriptive questions received *descriptive explanations* (DE) because there were only two attempts of textbook *descriptive responses* (DR) from learners and one from the teacher. This implies that the teacher sometimes promoted learners' conceptual development about the terms by allowing learners to receive the definitions of the terms at *interpretive response level 3* (IR3) (see Table 4.3). The descriptive questions and descriptive explanations are categorised IR3 in the analysis. In the interview, the teacher also indicated her use of descriptive explanation when explaining the terms and this suggests that the teacher values them (Gee, 2005).

The teacher was using questions which are more likely to deepen and widen learners' criticality and thinking, for example, using a wide variety of question types. In this, Ms Tulane's questions seemed to prompt learners to access the mathematical terminology as they were a combination of procedural and descriptive questions. Next is the teacher's expectation.

Teacher's expected definitions

The excerpt below shows that Ms Tulane led learners to predetermined definitions. It suggests that she steered the explanation process towards what she intended learners to learn, for example, she indicated that during her teaching she told learners to take 'range' as *"the distance between the starting point and the end point of the data"*.

<u>Excerpt 12</u>

IQ3: Looking at the whole topic you are teaching what terms did the learners get straight and what terms did they struggle with? What could be the reason?

P-R3: The words mean, mode and range were understood quite easily and they were easy to find than median and quartiles. they are easy to calculate…for example mean is what they used to call average, mode being what appears most in their

> *data... I taught them to think of it (range) as the distance between the starting point and the end point of the data though I was referring to the difference between the smallest and the largest value. Coming to the median and the quartiles, when the number of numbers is even they sometimes get a value which is not in their data so they get confused but when the number of numbers is odd the median is easy to pick because it appears to be the middle number*

Also in the excerpt above, Ms Tulane indicated that some terms were easily understood because learners were able to find their calculational values when the data were given, meaning that learners readily get those terms through procedural understanding. Whereas some of the terms' meanings, for example, 'range' were accessed through both procedural and descriptive explanations. Therefore, from the excerpt above it shows that the teacher's expected definitions were procedural and descriptive definitions. Next I explore the types of responses the questions received.

What type of responses did the questions meet?

Procedural questions

Most of the procedural questions the teacher asked received procedural answers as shown in Excerpt 10 above. In those procedural answers, they were very few procedural explanations such as; *"I divided the positive two by two…"* compared to 'valued' procedural responses such as, *"Forty six"* which the teacher and the learners were giving for the terms. This implied that the teacher accepted procedural explanations of the terms and learners were made to access the mathematical terminology procedurally. In this case, the teacher was socialising learners in the explanation of terms through a calculational or procedural Discourse (Setati, 2005b; Essien, 2011). It is a Discourse where methods of calculating or procedures of finding what the term stands for in mathematics are used to explain the term, allowing learners to only access the definitions of terms at *interpretive response level 2* (IR2) (see Table 4.6).

As Ball (1990) asserts that procedural demonstrations can help learners understand underlying mathematical principles, hence the meaning of mathematical terms. This was shown by learners' many procedural responses even when the teacher's question was a DQ, implying that learners readily understood the meaning of the terms by getting the values of those terms i.e. procedurally and at times they would explain the term through its formula.

Descriptive questions

There were three attempts by learners where descriptive explanations were given after the teacher's descriptive questions; these were lines 11 and 23 of Lesson 1 and line 118 of Lesson 2 as shown in Excerpt 11 above. Therefore, only three of the descriptive questions that the teacher asked received descriptive responses while the rest were answered procedurally. For example, a DQ *"Who (...) okay what is the range, can you define range, if not yet understood"* received a 'valued' procedural response, *"Fifty two... the range"* after teacher's probing utterance (see Appendix B).

There was only one precise textbook descriptive explanation given by the learner and this was re-moulded by the teacher. This implies that the teacher sometimes promotes learners' conceptual development of the terms at IR3, and in doing so the teacher used the mathematical language to skilfully develop learners in the use of the language. Giving and accepting descriptive explanations for mathematical terms is another way the teacher uses to facilitate learners' access to terminology, this is evident in the teacher's interview response below:

<u>Excerpt 13</u>

IQ3: Looking at the whole topic you are teaching what terms did the learners get straight and what terms did they struggle with? What could be the reason?

P-R3: "...I think they understood the first three because they are easy to calculate…for example mean is what they used to call average, mode being what appears most in their data and range, I taught them to think of it as the distance between the starting point and the end point of the data though I was referring to the difference between the smallest and the largest value".

It also suggests that the teacher valued descriptive explanations (Gee, 2005) in her explanations of the mathematical terms' definitions.

Learner responses

Ms Tulane started her two lessons with a question intentionally meant for learners to respond to, which shows she was prepared to involve learners in the discussions. For example, asking learners what they had found from the data she had given as home work where a learner responded saying that they had found the range. Ms Tulane, as if she was expecting such a response, further asked the learners to define the term 'range' and to say whether it falls under the five number summary or not. Involving learners in the classroom discussion increases learner understanding of what is being discussed, and the teacher is able to listen to and get information from the learner talk which she can then use to ask further questions while monitoring learner access to terminology.

Ms Tulane allowed learners to respond to her questions as they took part in the definition of mathematical terms, therefore, most of the questions asked, were responded to. She focused on one definition until it was understood by the learners. This was done by allowing long exchanges about one term (see Appendix A), hence building on learners' responses to define the terms (Powell et al., 2003) while leading them through a process of explaining those terms.

In most cases Ms Tulane would leave incomplete statements for learners to respond by completing those statements. The learners were answering in unison and the teacher did not condemn the behaviour showing the togetherness of the class which then makes the class a community of social morals (Gee, 2005) promoting a good atmosphere in the class as terms were being explained. The teacher used learners' unison responses as a yardstick of learners' attentiveness to what was going on in the class as shown in the excerpt below.

<u>*Excerpt 14*</u>

L1:3 Teacher: Ooh he is saying the range, what he has found out is that there is a range there. So range is there, is the range part of the five number summary,

L1:4 Class: No

…

L1:22 Teacher: Which is the median, what is the median, who can define for us, [looking for a volunteer and pointing to a learner] *let's go back a little bit*

L1:23 Learner: The number that divides that divides the data into two parts, right [asking if he was right]

L1:24 Teacher: Right, it is the middle value of that data when the data were arranged in order of size, right [paraphrasing and adding to learner's utterance]

...

L1:30 Teacher: but what are we looking for

L1:31 Class: Five number summary

L1:32 Teacher: Two outstanding values are...

L1:33 Class: Minimum value and maximum value

L1:34 Teacher: It is the minimum value and maximum value, right, ...they said find the range using the formula that the range is equal to highest score minus...

L1:35 Class: Lowest score

…

L2:8 Teacher: How many scores are there?

L2:9 Class: Twenty four

L2:55 Teacher: your five number…

L2:56 Class: Summary

L2:59 Teacher: …median and the...

L2:60 Class: Upper quartile

L2:71 Teacher: is it skewed to the…

L2:72 Class: Left

L2:79 Teacher: already stem and leaf is giving you what, the…

L2:80 Class: The scores

Also shown by leaving incomplete sentences for learners to complete is the teacher's lead to predetermined conventional definition of terms. Leaving incomplete sentences occurred in Lessons 1 and 2 where terms were being explained. Incomplete sentences are already structured statements trying to funnel learners towards what is expected of them, therefore, Ms Tulane was leading and funnelling learners towards predetermined definitions in the explanation of definitions.

5.4.4 Difference in meaning strategy

Ms Tulane engaged the class in the explanation of mathematical terms and sometimes would use associated terms to the term in question, for example, 'range' as associated to the terms 'maximum value' and 'minimum value'. For the other terms, she made sure that the learners took note of every term that builds up the phrases such as 'number summary' and 'box and whiskers'. For example, she made sure that learners understand the difference between the first quartile and the minimum value, the third quartile and the maximum value in order not to mix the terms when they present the five number summary. This was done to help learners understand the association of terms, hence, difference in meaning (DM) of the terms. This is evident in the following excerpts from Lessons 1 and 2:

<u>*Excerpt 15*</u>

L1:75 Teacher: Q1 what is Q1, the first quartile and the minimum value, are they the same

L1:76 Joy: No

L1:77 Teacher: what is the difference between first quartile and minimum value, third quartile and maximum value?

L1:78 Joy: Q2
...

L2:117 Teacher: The mean not the median, this is the mean, why is it the mean not the median

L2:118 Mike: Yes, it is the mean because it is from the formula

From the excerpt above, the teacher was making sure that the learners get the difference in meaning of the terms being explained.

The above discussed strategies best fit in the *communicative approach 2* (CA2) (see Section 4.2; Table 4.5; Figure 4.1) because Ms Tulane involved learners in the classroom interactive talks in all the strategies. Next I present the findings on teacher's legitimised definitions and their sources.

Section III

5.5 Teacher's Legitimised Types of Definition and their Sources

This was a classroom situation and from my experience as a teacher, all teachers teach for examination purposes, therefore, they teach conventionally. The types of mathematical definitions a teacher can use in class are the textbook definitions and these are mainly the procedural and descriptive definitions. Ms Tulane was teaching from a classroom textbook (see Section 5.5.2 below) therefore, she legitimised textbook definitions.

5.5.1 Types of definitions and how the teacher rewarded learner responses

From the above exchanges (Section II, Excerpt 10) it shows that Ms Tulane considered the calculational, procedural definitions. After asking the questions, "*How do you define the range*"..."*can you define range*" and "*what is the range*", in lines 5 and 43 of Lesson 1 as shown in the previous section above, learners were responding by giving values, showing that they were using procedures to find those values. In turn, Ms Tulane would ask learners to quickly calculate the range which shows that Ms Tulane was providing and making learners access the definition of the term procedurally.

Ms Tulane might have found out that her learners understood the terminology more readily procedurally than through a descriptive approach. The claim is from the observation that the teacher asked 23 procedural questions which received 24 procedural explanations and 17 procedural responses over 9 descriptive questions asked and received 3 descriptive explanations and 2 descriptive responses (see Appendix G, level of responses IR2 & IR3). Therefore, Ms Tulane was facilitating learners' access to terminology more procedurally than descriptively using the textbook as the source of information.

At times Ms Tulane would ask questions calling for a descriptive definition only to be turned into procedural by the way the learners respond to it but the teacher would not condemn the behaviour. When Ms Tulane asked questions like: "*how do you define the range*" and "*can you define range*" lines 5 and 43 of Lesson 1, she was imposing typical DQs which were entitled to a *Textbook Descriptive Definition* (TDD) but learners would respond by giving

Textbook Procedural Definition (TPD) which Ms Tulane accepted without probing for the TDDs (see Appendix A and Table 4.2).

The teacher encouraged learners to use previous knowledge in an attempt to define the term being discussed and she rewarded the learners' responses by agreeing with what they were saying or by rephrasing their responses. This suggests that Ms Tulane led learners to predetermined definitions and in her responses to learner responses, she would steer learner responses towards what she intended learners to learn. To do this, she incorporated ways to help her steer the responses as shown in the analysis (see Appendix C and E).

When rephrasing learners' explanations, Ms Tulane would add or discard some information in the given contributions to perfect the explanations. And by this, she provided learners with access to mathematical terminology and to ways of talking (Gee, 2005; Khisty & Chval, 2002), therefore, mathematical terms were made explicit. Below is an excerpt where the teacher was making the term median explicit to the learner.

Excerpt 16

L1:71 Teacher: you say the median is the middle number, what does middle mean

L1:72 Joy: Number in between

L1:73 Teacher: In between what

L1:74 Joy: Number in between the one this side and the other that side
…
L1:81 Teacher: You understand now, you have to divide the data into...

An example of a mathematical TDD of the term e.g. range would be 'range is the difference between the highest and the lowest observed values of a data set'. Such a descriptive response would best answer a question "*how do you define the range*" other than a value e.g. "*Forty eight*" line 50 on Lesson 1 (see Appendix A). A descriptive response gives learners a conceptual understanding (Kilpatrick, Swafford & Findell, 2001) of a mathematical terminology as was observed happening in the extract below for the term 'median':

Excerpt 17

L1:22. T: Which is the median, what is the median, who can define for us, [looking for a volunteer] *let's go back a little bit*

L1:23. L: The number that divides that divides the data into two parts, right [asking if he was right]

L1:24. T: Right, it is the middle value of that data when the data were arranged in order of size, right; [paraphrasing learner's utterance] *next what is the third quartile*

The above extract gives us an explanation of the term 'median' which is more descriptive than procedural in the sense that it tells us the position where a median is found in a data set. A descriptive understanding is important in that it also helps learners not to forget the procedures, once learners have accessed a term descriptively their abstraction grows and procedures just come in place automatically. Such understanding was referred to as relational understanding by Skemp (1991) and Setati (2005b) calls it a Conceptual Discourse where mathematical concepts are discussed or described. In the extract the teacher was also observed rephrasing learner's answer and giving a more completed conventional definition when the learner had provided a partial one.

It showed that in both the lessons Ms Tulane led the class through TPDs because the way she conducted lesson two was not very different from what she did in lesson one. Below is an excerpt showing that Ms Tulane asked procedural questions more often than descriptive questions and learners would procedurally define the terms.

Excerpt 18

L1:36 Teacher: find the range and

L1:37 Class: Summary

L1:45 Teacher: Quickly calculate it

L1:46 Learner: Fifty two... the range

L1:47 Teacher: What is the range here, what is the range

L1:48 Learner: It's forty five

L1:49 Teacher: what is your range here,

L1:50 Class: Forty eight

L1:53 Teacher: Which one is in the middle

L1:54 Class: Eighty two

L1:67 Teacher: find the highest score, find the lowest score

L1:68 Learner: Fifty

L2:19. T: Eeh Joy what did you write, what is your lower quartile, how do you find the lower quartile?

L2:20. Joy: I divided the positive two by two…

L2:23. T: Remove the lower quartile, just do one thing at a time so that you are able to (...), good, eeh start with your median, remember we start with our median

L2:24. Joy: We divide our data into two, then we calculate the median

L2:25. T: Right [with an encouragement gesture]

L2:26. Joy: Then I look for the lower quartile I found that its twenty three

L2:27. T: Twenty three [revoicing learner's utterance]

L2:28. Joy: Yes

L2:29.T: How do you find the lower quartile tell us

L2:30. Joy: I jumped this number, then I got to [points at 3 in between 33 and 34 in row three]

It is very important for learners to access both TPDs and TDDs to make the explanation of the term complete. An explanation is one discourse practice that is central to mathematics teaching and learning and it is an utterance that should be designed to explain the 'why' (i.e., reasoning and proof), explain the 'how' (i.e., outline a procedure), and explain the speaker's thinking. An explanation is admittedly broad but it is concurrent with informal definitions in use in the classroom, where the term 'explain' is used.

When explaining, teachers often made use of different tools such as the graphs, models and demonstrations, but still they have to reach a satisfactory sense making story for a complete explanation. Yackel and Cobb (1996) point out that "what counts as an acceptable mathematical explanation and justification is a sociomathematical norm" (pp.461) in the classroom. Therefore, Conceptual Discourse and Calculational Discourse (Setati, 2005b), the TPDs and the TDDs which Moschkovich (2003) referred to as formal definitions are the key powers of Definition Discourse.

Sometimes Ms Tulane would revisit learners' ideas about the terms to use them to ask questions. There are many learner responses which were used to ask questions and in the interview (Except 19 below) the teacher indicated that she uses learners' responses to ask more questions as a follow-up, implying that she evaluates learners' understanding of the terminology through these further questions.

<u>*Excerpt 19*</u>

IQ7: What classroom communications do you see effective in making the learners understand mathematical terms?

P-R7: I might use the responses to ask more questions as a follow-up…

The teacher also used learner responses to ask leading questions to predetermined definitions as she probed learners for more information about the mathematical terms, and evaluating how much understanding the learners have about the term in question. Therefore, Ms Tulane used learner responses to ask further questions as shown in the excerpt below.

<u>*Excerpt 20*</u>

L1:65 Teacher: you say the median is between sixty seven and sixty two

L1:66 Learner: Yes

L1:67 Teacher: how many scores do you have one two three four five [counting the scores together with the learner] *seven so which one is in the middle*

L1:68 Learner: Fifty

L1:69 Teacher: so let's just count seventy eight sixty seven which one is the middle number, you know what, your scores are not the same

L1:70 Learner: Yes
...
L2:26 Joy: Then I look for the lower quartile I found that its twenty three

L2:27 Teacher: Twenty three {re-voicing learner's utterance}

L2:28 Joy: Yes

L2:43 Teacher: And what is the inter quartile… [Disagreeing with Brenda's answer]

L2:44 Brenda: Range

L2:55 Teacher: your five number…

L2:56 Class: Summary
…
L2:113 Teacher: now what's the formula for the mean, go back and check the formula, how did you write the formula, how do we write our formula

L2:114 Mike: X bar is equal to the sum of...

L2:115 Teacher: Good, x bar is equal to the sum of all squares [writing the formula on the chalkboard]

Therefore, from the excerpt above, it is clear that the teacher explicitly defined terms in her classroom by questioning learners until the explanation of the term in question is clear.
By legitimising some and discarding some of the learners' definitions it shows that the teacher rewarded learners' responses accordingly. The above discussion showed that, what the teacher accepted is what she legitimised and what was not accepted is what she did not legitimise in her terminology explanations. The types of definitions are discussed in Chapter 4 (see Table 4.2).

From the above discussion it can be concluded that the teacher was using both procedural and descriptive questions to facilitate learners' understanding of mathematical definitions of the terms through a question and answer strategy (Brodie, 2007). Also from the discussion the teacher was developing learners' both procedural and conceptual understanding about the mathematical terms i.e. facilitating learners' access to terminology through IR Level 2 and IR

Level 3. Therefore, the teacher legitimised both the procedural IR2 and descriptive IR3 definitions (see Table 4.6) of the terms whose sources are discussed below.

5.5.2 Sources of definitions

Mostly when a teacher plans for a lesson, always she has a source of the information she is going to teach. The terms which the teacher was teaching about were from a textbook and their definitions were textbook definitions. From my learning and teaching experiences, the terms learners are taught in the introduction to statistical measures of dispersion are textbook terms. For example, terms such as range, interquartile range, median and mean are terms which I got the opportunity to learn about from the mathematics textbook and taught learners from it. These are the terms Ms Tulane was teaching and she was using a classroom textbook.

The evidence for Ms Tulane using classroom textbook as source of definitions are lines 34 of Lesson 1, 65 and 89 of Lesson 2 (see Except 21) where she asked learners to look at exercise eight point six on page one hundred eighty nine. Though she compared the textbook's meaning of symmetrical data with some books in line 65 she still respects the definitions from the textbook-in-use and she insisted that learners should always bring their textbooks to class, line 89 of Lesson 2.

The two types of definition the teacher used were both textbook based definitions. In line 34 of Lesson 1 Ms Tulane gave learners a textbook exercise which shows that she was using the textbook conventional definitions and was teaching towards national examinations. She also encouraged learners to use textbook formulae. Therefore, Ms Tulane used the textbook as a source of definitions and as a textbook-in-use in the definition of the mathematical terms. Below are transcription picked areas where Ms Tulane made an indication of textbook use or reference which shows that she used the classroom textbook as a source:

<u>*Excerpt 21*</u>

L1:34. T: It is the minimum value and maximum value, right, I want us to look at exercise eight point six on page one hundred eighty nine, there it says... in your groups, the baker keeps (...) of number of dough nuts sold a day for three weeks, the numbers are (...) there is data that is listed there, they said find the range using the formula that the range is equal to highest score minus

...

L2:65. T: But it's always the same, right lets read here, some books when they talk about skewed, they are saying a symmetrical data set is balanced or you heard so, that it have to be exactly, exactly on either side of the median, note that it doesn't have to be exactly equal on both sides to be called symmetrical. This is good what you are doing, then calculate thirty three minus twenty three. It's what? Twenty three coma five minus fifteen, so I want you to read the drawing, you must read about symmetrical, skewed to the right, skewed to the left, when is your box skewed to the left, when is it skewed to the

…

L2:89. T: Where is your textbook, please bring the textbook to class all the time, you see now if you had your textbook, you would be comparing how many did you get, but if you count as one like this it is a problem if you are wrong you are both wrong, do you see, how many did you get

In her interview response P-R4 (see Appendix B), Ms Tulane pointed out that she encourages her learners to read from the textbook in order to deepen their understanding of the terminology after class instructions and this is evident in the excerpt below:

<u>*Excerpt 22*</u>

IQ4: Do you borrow some definitions of the terms from other sources e.g. other textbooks, life situations or other people's definitions (verbal or texts). Why?

P-R4: I use any source of information available which can help me to make the learners understand, I use definitions of different sources I send them in their groups, and these are permanent groups in that class, for example when I was teaching them about the word data, for them to understand what data means I also encourage my learners to go and ask other people especially teachers here at school even after I have taught them the terminology or to read around and from the textbook for them to understand better other than just from me as their teacher and if they get something different they should come back and tell us in class what they have found different…

Different sources

Though in the interview excerpt above Ms Tulane had indicated that she uses any source of information available and definitions of different sources, she did not practice it in the observed lessons instead she used the textbook only, as the source of the definitions. When she asked learners to go and collect data in groups in the introductory lessons it was for learners to understand what data is; when she encouraged learners to ask other teachers, to read around and to read from the textbook, she could have been attempting to lead learners to deeper understanding of the definitions. Also, from my perception, this response suggests that teacher's motive behind such encouragements is that some teachers might explain the terms in a different way which might promote deeper understanding in learners. This is another way of enhancing their understanding of the definition. In this, Ms Tulane used different approaches in the definition of terms while her main definition source was a textbook.

Ms Tulane's last statement in P-R4, *"I want them to be resourceful also"* seemed to mean each learner was to bring his or her own understanding of the term and that understanding will then be used in class. Going back to communicative approaches, what Ms Tulane gave as different sources of information in the above excerpt were actually different approaches she used to facilitate learner access to terminology, her source of definition was the textbook.

Section IV below presents the forms of interactions and the language used.

Section IV

5.6 The Classroom Interactions and Language-in-use

From the above discussed sections, it is clear that Ms Tulane's explanation process of the mathematical terms was influenced by the interactions which took place in the classroom and in these interactions language was used. Therefore, in this section the types of interaction used and the language-in-use are presented.

5.6.1 Classroom interactions

If teachers can help learners to develop mathematical reasoning skills, algorithm competence and problem solving skills through interaction in mathematics classrooms (Moschkovich, 2003), then it means interaction is also important in helping learners develop terminology competence.

Ms Tulane used groups of four or five learners in a group. She focused her groups on one term for a lengthy period of time to create time and space for the groups to discuss and understand the terms and their places in mathematics. She socialised the groups in an interactive/authoritative approach (Scott et al. 2006) leading them through a process of explaining the meanings of the mathematical terms (see the use of teacher-groups as a form of interaction in class in the excerpts in 5.3.2 Section I above. Also see 5.4.1 Section II).

A teacher-group pattern, the main interactive pattern in class (see Appendix F), suggests that the teacher was creating a conversational and a sound involvement of learners in the explanation of terms through a *classroom interactive talk 1* (CIT1) (see Table 4.3). To alternate teacher-group pattern, Ms Tulane also used the *classroom interactive talk 2* (CIT2) (see Table 4.3) as another form of interaction so as to avoid creating a monotony of one type interactive pattern in class. The CIT2 was her second form of interaction which gave a fair chance to learners to participate and freely airing their individual ideas (see 5.4.2 Section II).

For this study I decided to bring to attention only the two discussed forms of interactions, the CIT1 and CIT2, because they were the most prominent teacher-led patterns of interactions in class.

The teacher's initiation

At times when learners are stuck teachers need to provide useful information about what they are expecting them to do. Sparingly, Ms Tulane provided learners with some helpful information to access the meanings of terms i.e. *initiate by providing information about the new term* (IPINT) (see Table 4.4) e.g. *"arrange from the highest to the lowest"* in L1:51, and she used the *leading questions* (LQ) and/or *prodding leading questions* (PLQ) (see Appendix F) to help learners define the terms e.g. *"what is the highest score there"* in L1:53. Such hints and questions can remind learners of what they are expected to do in order for them to define terms (see 5.4.2 Section II).

It shows that Ms Tulane was the main source of information learners needed to understand the meanings of the mathematical terms. The IPINT, LQ and PLQs were useful because after such initiation, Ms Tulane's response to learners' ideas would direct learners to where she wanted them to go. By this she was developing learners' understanding of the terms she was teaching.

5.6.2 Language-in-use

To accommodate all the learners, Ms Tulane would sometimes use *ordinary language* (OL) in-between her continuous use of *mathematical language* (ML), throughout her teaching. Considering that language creates a political view when people talk and write, she used both OL and ML mainly to control the class and to instruct learners so that every learner gets the instructions clearly. Though she did not use *home language* (HL) in her utterances in the explanation, she allowed learners to use their home languages in group discussions but would give their responses either through OL or ML. The use of these languages in class was to create a social learning environment for multilingual learners and thus making the class a community of mathematics participants (Gee, 2005). As explained earlier, OL and HL are considered as *non-mathematical languages* (NML) in this study. The use of NML and ML in class is evident in the following excerpt.

Excerpt 23

L1:5 Teacher: Okay let's just write it even though, because that's what he has learned about [writes the term 'range' on the board], *saying the range, how do you define the range, what is the range* (ML)

L1:6 Class: Highest score minus lowest score (ML)

L1:10 Teacher: Three, why three and not... (ML)

L1:11 Nicho: Quartile, it's the lower quartile which is the median of the first half (ML)

L1:22 Teacher: Which is the median, what is the median who can define for us, (ML)

L1:23 Learner: The number that divides that divides the data into two parts, right [asking if he was right] (ML)

L1:24 Teacher: it is the middle value of that data when the data were arranged in order of size, right, (ML)

L1:34 Teacher: they said find the range using the formula that the range is equal to highest score minus... (INCS)

L1: 35 Class: Lowest score

L1:55 Teacher: Eighty two minus the lowest... (INCS)

L1: 56 Class: Thirty four

...
L1:81 Teacher: You understand now, you have to divide the data into... (INCS)

L1: 82 Peter: Four

L1:91 Brenda: Hasifuni lawa mafour four asiarrange ne {we don't like these four fours let us arrange them, ok} (NML)

L1:92 Teacher: And then first quartile, le {this one} right do the discussions, eeh Brenda you must remind your group mates, (NML)

...
L2:2 Thabo: ngu number bani lapha {what is the number here} (NML)

L2:3 Class: Kunye, kubili, kubili {one, two two} (NML)

L2:4 Thabo: Kuthathu, kuthathu, kuthathu, kuthathu, Kuthathu, kune, kuhlanu {three, three, three, three, three, three, four, five}}[writing on the board] (NML)

L2:5 Teacher: Eh people I would say (…) you don't say one, two. three you would rather say eleven, twelve, thirteen just to use the correct numbers then, that way helps you to remember this, you then say twenty one, twenty three, okay

L2:6 Class: Fourteen, fifteen, sixteen, seventeen, eighteen (ML)

L2:7 Nicole: Ehe wena awuyibalanga {you, you did not write it} (NML)

...
*L2:17 Teacher: Please, please help her (*NML)

L2:18 Nicole: Unamanga, ayisi, [You are lying, it's not] (NML)

...
L2:57 Teacher: median and the... (INCS)

L2: 58 Stella: Right

L2:59 Teacher: is skewed to the left or skewed to the… (INCS)

L2: 60 Class: Upper quartile

L2:89 Teacher: Where is your textbook, please bring the textbook to class all the time, (NML)

The excerpt above shows that Ms Tulane would only use ML when explaining or talking about the terms and asking questions. For example, in her *incomplete sentences* (INCS) which learners were meant to complete, she used the mathematical language so as to encourage the use of the mathematical language and the development of learners' confidence in using it (see Excerpt 23 above). The teacher was providing the appropriate use of mathematical terminology in the abstraction level so that learners would access both the terminology and its place in mathematics. By finding the terminology's place in mathematics it means to be able to talk like, think like, believe like, and value like...mathematicians (Gee, 2005). Therefore, she used mathematical language as a resource in the explanation of mathematical terms (Gee, 2005) (see Appendices B and E).

It also shows that Ms Tulane was skilfully developing learners in the use of the language hence they see the importance of the language and put the skills taught by the teacher into practice, therefore, understanding of the terminology. Because the teacher used ML which is acceptable in mathematics, it suggests that she was developing mathematical talk in learners which they were meant to realise that it is different from other ways of talking. She used the textbook for mathematical meanings; therefore, she used ML to engage learners in the definition of terms as they put the ML skills taught by the teacher into practice.

In the interview, Ms Tulane indicated that she uses ML because the class consists of learners of different languages and she needs to unit them through one language. This shows it was a multilingual class. She uses mathematical language because that is the language she feels comfortable with when teaching. It is the mathematics' accepted language which she wants her learners to acquire the knowledge of mathematics through it in order for them to be confident when communicating mathematics. She then allows the learners to use their home languages when they are discussing at group level to share gained understandings, teacher's concerns about language-in-use are exemplified in the following excerpt.

<u>*Excerpt 24*</u>

IQ6: Why were you using the language of instruction (language of mathematics) throughout your teaching?

P-R6: We do have learners who speak different languages, in addition, I even have foreign children from Zambia and Lesotho in that class, a lot are Zulus and I am a Xhosa, so I…find it unfair to use my language which will make a few to benefit and again I find myself confident in using English...to get the definitions straight in the accepted language of mathematics... (ML)

IQ7: What classroom communications do you see effective in making the learners understand mathematical terms?

P-R7: learners need to discuss on their own and with this they share their understandings and they do that using their languages… (NML)

To provide comfortable social grounds for the teaching and learning process of mathematical terms the teacher emphasised on group work, this allowed the use of NML by learners during their discussions to activate members' understanding (see interview Excerpt 24 above). To substantiate what she said in the interview, Ms Tulane did not condemn the use of these languages in learner group discussions as in lines L1:91, L2:7 and L2:18 in Excerpt 23 above, showing that she accepted the use of NML except when learners were to present to the class as in lines L2:5 and L2:6.

There was also the use of gestures and expressions by the teacher in the explanation of terms. This implies that the teacher used body language to accompany verbal utterances. The body language was observed being used to emphasise a point in the explanation process. Below is an excerpt showing areas where body language was used.

Excerpt 25

L1:10 Teacher: Three, why three and not... [with a surprised face]

L1:30 Teacher: One, two, three, [pointing to Q1, M, and Q2]

L1:43 Teacher: Who (...) okay what is the range, can you define range, if not yet understood [opening the hands with a sharp facial expression in surprise]

L1:57 Teacher: Which is [pointing at the data set on the board]

L2:30 Joy: I jumped this number, then I got to [points at 3 in between 33 and 34 in row three]

L2:31 Peter: No, no [with flying hands and head shaking in disagreement]

L2:37 Joy: Upper quartile, for the upper quartile, I'm going to take the second half [pointing at the data set on the board]

L2:61 Teacher: did you see what I did there? [pointing to the board]

L2:121 Teacher: No, so how must you calculate the mean [hands gestures wanting to know how the mean is calculated]

L2:123 Teacher: Yes you must use this formula [pointing to the formula written on the board]

The above excerpt shows that the teacher used Grammar 2 to accompany verbal communication (Gee, 2005) in the explanation of mathematical terms. Also implied is that gestures are a form of communication the teacher approves in this class as the data shows that even learners were using gestures to communicate with the teacher (lines L2:30, L2:31 and L2:37, Except 25) where Joy and Peter used hand gestures as they were talking to the teacher.

Ms Tulane also indicated in the interview the use of body language as a form of communication when she said learners normally show by facial expression if they do not know the term which she will be teaching. This communication then forces her to switch to questions seeking their prior knowledge about the term (see interview excerpt below).

Excerpt 26

IQ1: What do you consider as a better way of introducing mathematical terms to learners in your class?

P-R1: …when I write something on the board which they do have a clue about it, its normally shown by their facial expression…eh… I just switch to questions of wanting to know what they know about that...

In Summary: the teacher's accommodativeness in the Definition Discourse

In addition to chalkboard use, Ms Tulane used a calculator and drew diagrams to explain the terms. Expressions and gestures were used to accompany verbal talks in the emphasis of some ideas (Gee, 2005) as actions of emphasis. The teacher gave instructions, hints and clues to assist learners in the explanation of terms, she also insisted on group discussions so as to give learners an opportunity to share their understandings through the use of their home languages.

Ms Tulane acknowledged learners' contributions, a respectful behaviour and an established norm which gave learners a feeling of being accepted. By addressing learners as 'people' and also using 'we' and 'us' in class, the teacher was accommodating them as 'colleagues' in the classroom. She encouraged group work all the time for shared understanding of meanings, making sure no learner was left out in the community of working together. All this was encouragement for learners to participate and contribute to their own learning of mathematical terminology (Webb & Webb, 2008; Lobato et al., 2005).

The feeling of being accepted in the process of explaining the terms is evident in the blurting out behaviour of ideas by learners without being called upon by the teacher. The teacher did not condemn the behaviour, instead she accepted it. It shows that there were assertive learners in this class which the teacher had to accommodate in order to create a social learning environment for all learners and thus making the class a community of mathematics participants (Gee, 2005). Therefore, blurting out was part of the classroom Discourse and the teacher had to appreciate learners' efforts. But this behaviour did not outdo teacher's authority of *calling upon learners* (CL) to respond, the teacher still called upon learners to respond to her questions. Sometimes, the learners displayed a *blurting out behaviour* (BB). Some of the above discussed actions were observed happening as shown in the excerpt below while some are already discussed in the chapter:

<u>Excerpt 27</u>

L1:9 Nicho: We only look to three first quartile (BB)
...
L1:46 Learner: Fifty two... the range (BB)

L1:82 Peter: Four (BB)

L1:72 Joy: Number in between (BB)

L1:77 Teacher: are you working as a group, you must work as a group, so discuss, (GD)

L1:78 Joy: Q2
…
L2:10 Thabo: [counting the scores to verify] *ja {yes} twenty four* (BB)

L2:11 Teacher: Right, thank you, your next question, Brenda (CL)

L2:36 Teacher: You understand Joy now, can you do the upper quartile for us (CL)
...
L2:39 Teacher: Who wants to come and do the range for us, every time you come across questions try and do them on your own the other questions that we had gone through, Joe (CL)

L2:40 Joe: Yes, [coming to the board] *the range, I find the highest number, for this one the range will be (...)*

L2:51 Teacher: who wants to come and draw it, can we have someone who wants to come and draw a box and whiskers who wants to come and draw the box and whiskers, okay Lerato (CL)

...

L2:113 Teacher: how did you write the formula, how do we write our formula

L2:114 Mike: X bar is equal to the sum of... (BB)

5.7 Conclusion

In this chapter, I have presented the analysis and findings of the study. From the analysis, the researcher gained an understanding of how the teacher defines mathematical terms in the multilingual classroom. The analysis of the lesson and the teacher interview transcripts have been presented to show what the teacher legitimised, the kinds of interactions that the teacher allowed in her classroom, the teaching strategies the teacher employed and also the sources of the definitions the teacher used. From the analysis presented above, the teacher used different communicative strategies to define the term to the learners; the teacher used only the textbook to define the mathematical terms. The teacher encouraged learners to define the mathematical terms using mathematical language. Therefore, the teacher's interactive authority in class was discussed. In the next chapter, I will present the summary of the findings and the discussion of the results in relation to the literature review and the theoretical framework that guided the study, while the implications, limitations, recommendations as conclusions of the study come in the subsequent chapter.

Chapter Six
Discussion of findings

6.1. Introduction

This chapter presents the discussion of the results of the study. As was indicated in Chapter One, some research in the area of mathematics education showed that learners encounter difficulties in understanding mathematical language especially in the multilingual schools in South Africa (Setati, 2005; Kazima, 2008; Webb & Webb, 2008; Setati & Barwell, 2008). It was important for this study to investigate how the mathematical terms are explained to the learners. It was important because the mathematical terms are important in the making of the mathematical language. Understanding the mathematical terminology may then help learners understand the underlying mathematical concepts and be able to successfully uncover the messages of and about mathematics (MacGregor & Price, 1999). Gee's (2005) perspective of the situated and social-cultural theory was used as a guiding framework to explain the teacher's ways of combining and integrating language, actions, interactions, ways of thinking, believing, valuing and using various symbols, tools and objects in the explanation of mathematical terms. While Scott et al.'s (2006) interactive/authoritative approach was used to illuminate the interactions the teacher used with the learners as she explained mathematical terms.

6.2. Summary of the Findings

The teacher's patterns of practice were categorized in a table form as summary categories of analysis to back-up the inductive argument in the findings as explained in Chapter Five.

Table 6.1: Summary Categories of the Findings

The Study's Insightful Areas		Findings	Code	Indicators of the findings
The outstanding discourse practices undertaken	How access to mathematical terminology by learners was provided	Chalkboard as a thought pad	WLI	Teacher writes learners' ideas on the board
			LCB	Learners write their ideas on the chalkboard
			RCW	Teacher and learners refer to chalkboard work
		Teacher-group and teacher-class interactions	CIT1	Teacher poses questions and/or instructions to learners in groups
			CIT2	Teacher asks whole-class questions
		Question and Answer strategy	QAS	Teacher uses question and answer teaching method
		Difference in meaning strategy	DM	Difference between terms' meanings strategy used to teach definition of terms
		Textbook definitions	TPD, IR2	Textbook procedural definition of interactive response level 2 used
			TDD,	Textbook descriptive definition of interactive response level 3

			IR3	used
	Resources or tools used	Languages-in-use	ML	Mathematical terms are used in an English utterance
			NML	OL is used in the explanation of terms
				HL is used in group discussions about terms
	Other useful practices in the Definition Discourse	Leaving incomplete sentences	INCS	Teacher leaves incomplete statements as structured mathematical leading statements as a strategy of teaching mathematical language
		Re-voicing learner response	RV	Teacher re-voices learners' responses for other learners to hear to rephrase in mathematical language

The table above summarizes some of the findings of this study. Although a detailed explanation of the concepts was done in the previous chapter, there is still a need for a rigorous discussion of some of the individual concepts in relation to literature, as they represent the findings of the study. Below is a detailed discussion of the above summarized and other concepts from the analysis.

6.3 Discussion of Results

The Definition Discourse of the classroom, which is summarized in Table 6.1, consists of a number of practices but not all are presented, therefore, below is the presentation of the major and minor ones from the analysis point of view.

6.3.1 Chalkboard as a 'thought pad'

The chalkboard was one of the teaching strategies in the classroom. The teacher wrote learners' contributions on the chalkboard, a *Definition Discourse* (DD) practice she carried out to facilitate learners' understanding of the terms. Most of the time Ms Tulane would write on the board only those contributions which had something important with respect to the term in question[1]. If learners' contributions, which were written on the chalkboard, were found by the teacher to be important in defining the terms, then chalkboard use is assumed to be playing a part in facilitating learner access to mathematical terminology.

Sometimes Ms Tulane would allow learners themselves to write on the chalkboard especially when they could not verbalize their thinking. This is a DD practice because the chalkboard, in this case, seemed to have been used as a 'thought pad' where everyone including the owner of the idea was made to see and read individuals' thinking, thereafter, use the 'thoughts' to access correct definitions of terms together as a class. This shows that the chalk board was considered as providing an opportunity to monitor the class's talk, direction and thinking (Franke et al., 2009). It is important for learners to see their thinking because they learn effectively by seeing (Graber, 1990).

It was also observed that some chalkboard work was used as reference work when there was a need, for example, when Joe said, *"because it is the highest number that is given here"*

[1]Contributions which the teacher felt would help bring to surface the explanation of the term.

pointing at the chalkboard written work. Conversely, Ms Tulane used the contributed ideas on the chalkboard to summarize and lead learners to a correct predetermined definition of the term in order for them to understand and move on. Using chalkboard work as referral work and as summaries of term explanations was a DD practice the teacher used to facilitate learners' access to mathematical terminology.

When Ms Tulane involved learners in the chalk and talk strategy, the strategy automatically became that of a *communicative approach 2* (CA2) category.

6.3.2 Verbal utterance of terms

At times the mathematical terms were written on the chalkboard as discussed in Section 5.4.2 in the previous chapter but most of the time the terms were verbalized. In the interview the teacher indicated that she sometimes wrote the term on the chalkboard, especially when introducing the terms. This means that sometimes the terms were verbalized and then written on the board if they had gone past their introduction stage, using the example given in the same Section 5.4.2 of the term 'range'. Writing on the board and or verbalizing the term are DD practices which the teacher incorporated in the explanation for learners to access the mathematical terminology.

6.3.3 Group seating arrangement

Ms Tulane's idea of addressing learners after making sure that all learners were quiet, seated in their groups facing the chalkboard, and the chalkboard cleaned before she starts the lesson, was a DD practice for class control. Cleaning the chalkboard before the lesson starts is a norm and a practice the teacher had put in place (Gee, 2005).

The seating arrangement was in groups, and there was teacher-group interaction as a teaching strategy which seemed creating and engaging learners in a pattern of interaction in the explanation of mathematical terms (Scott et al., 2006). Group seating arrangement is a strategy for problem-based lessons that the South African mathematics curriculum emphasizes (DoE, 2001).

Ms Tulane did not practice an artificial solution to problem-based learning i.e. sitting learners in groups while pursuing individual learning; instead she used it as a teaching strategy insisting on collaborative work and shared ideas in those groups. Throughout the lessons she would remind learners to work as a group through *group discussions* (GD) in most classroom activities. Therefore, sitting learners in groups is a DD practice to enhance shared knowledge and bring about meaningful constructed understanding of the terminology by learners through the *classroom interactive talk 1* (CIT1) form of interaction.

6.3.4 Whole class and teacher-group interactions

Teacher-groups and teacher-whole class interactions were used in the classroom. Groups and whole-class interactions were both DD practices the teacher used in the explanation of terms. The teacher used teacher-groups interaction as her main interactive pattern in class (*classroom interactive talk 1* (CIT1)) and in this she created a conversational involvement of learners in the explanation of terms. By using participatory teacher-group interactions, the teacher was, in my view, engaging learners not just physically but also intellectually in the explanation of terminology. This was evident in the teacher's insistence on working in groups, a DD practice the teacher used to enforce group effort before a representing member of a group responds to teacher's questions. The teacher would then use learner responses to prompt further elaboration, therefore, evaluating learners' understanding of the terms. Although Ms Tulane used learner responses to initiate classroom conversations, they seemed to be effective when she used whole class and teacher-group classroom interactions.

The teacher-whole class, *classroom interactive talk 2* (CIT2), was used as an alternate interaction to teacher-groups form of interaction. It is a DD practice giving learners a chance to air individual views especially the fast learners. This was observed to be so when the teacher sometimes called out learners names without insisting on group worked ideas.

In these two types of interactions, it was observed that all the groups and most of the individual learners participated in the explanation of the mathematical terms. Therefore, these interactions helped the teacher to facilitate learners' access to the mathematical terminology. This was evident when the teacher was observed accepting responses by re-voicing and paraphrasing learners' correct and partially correct definitions. Generally, re-voicing, remoulding and paraphrasing are done for other learners to hear and understand others' contributions clearly (Pressley et al, 1989; Enyedy et al., 2008; Herbel-Eisenmann et al., 2008). It also showed teacher's feelings and the importance she attached to the learners' contributions about the terms i.e. valuing and accepting learners' ideas (Gee, 2005; Moschkovich, 1999).

Ms Tulane also exhibited good listening skills which were necessary in fostering fruitful interactions in class (Davis, 1997) and helped learners to use the mathematical terminology appropriately by restating learners' explanations in a more precise mathematical way. This was also a way of helping learners to communicate mathematically by modelling correctly the mathematical discourse in the class. The teacher was providing learners with both access to terminology and to ways of talking (Gee, 2005; Khisty & Chval, 2002), therefore, mathematical terms were explicitly taught. By acknowledging learners' ideas, Ms Tulane performed a DD practice which was very important in encouraging learners to participate and contribute to their learning of mathematical terminology, hence participating in the construction of their own knowledge of the mathematical terms (Webb & Webb, 2008; Lobato et al., 2005).

In this study, therefore, the two forms of interactions were the most prominent patterns of interactions in all the lessons observed. In both forms of interaction, Ms Tulane's authority was apparent in that she was the initiator. Which shows that the patterns were both teacher led interactions which best fit in Scott et al (2005)'s I-R-F patterns of interactions. Scott et al (2005) argued that the interactive/authoritative discourse is a teacher led interaction in the I-R-F. Therefore, both forms of interaction became the interactive/authoritative way of combining and integrating language, actions, and ways of thinking, believing and valuing (Gee, 2005) in the explanation process of the mathematical terms through the CA2 category.

6.3.5 The use of questions

It was observed that in Lessons 1 and 2 is where explanation of mathematical terms took place the most. The roles in the classroom were teacher-as-questioner and learner-as-answerer and there were no observed incidences where learners were asking the teacher questions about the terms.

Brodie (2007) warns that engaging learners in questions and answer sessions in the classroom does not develop learners' mathematical thinking. She argues that, the teacher will be looking for a predetermined answer. In the study, this was catered for by the use of a wide variety of question types. The teacher used both procedural and descriptive questions to engage learners in correct, meaningful, and applicable definitions of the terms thus engaging them in mathematical sense-making activities (Adams, 2003). In those procedural and descriptive questions, there were probing and leading questions to bring about variety in questioning. This was the most important DD practice among others which the teacher performed in the explanation of the mathematical terms. It was an important practice in that the whole process of terminology defining in this study seemed to rely on the teacher's question and answer strategy of teaching.

Ms Tulane's procedural and descriptive questions seemed to promote learner access to mathematical terminology because learners were seen actively participating. Mclntosh and Jo Draper (1996) argue that question-answer relationship strategy promotes an active learning stance in mathematics reading; hence in mathematics terminology learning. When Ms Tulane used questions in the question and answer strategy to explain the terms, it was a DD practice which was used to seek learners' ideas about the terminology being taught.

6.3.6 Difference in meaning of the terms as a teaching strategy

Ms Tulane found it important to expose learners to the differences in meaning of some terms which she felt might confuse learners' understanding. From the observations, there were some questions where the teacher was asking for differences of terms, for example, when she asked "*what is the difference between first quartile and minimum value, third quartile and maximum value,*" (see Appendix A, line L1:77) and *"The mean not the median, this is the mean, why is it the mean not the median"* (see Appendix A, line L2:117). She used such questions to explicate the terms to learners. This is a DD practice Ms Tulane used to socializing learners to the understanding of phrases and terms through their associated terms and also to put right the meaning of the phrases and terms with sufficient precision to ensure determinate value of the terms to learners (McGee, 1997).

It is a DD practice she used to ensure learners understand the difference between the meanings of some terms. This was to facilitate learners' access to terminology by differentiating the terms from what they are not to what they are (Marton et al., 2004; Runesson, 2005). The teacher used difference in meaning as a teaching strategy at the same time evaluating learners' understanding of the terms she was teaching.

6.3.7 Textbook definitions

Although she was imposing typical *descriptive questions* (DQs) which were entitled to *textbook descriptive definitions* (TDDs), not all DQs received *descriptive explanations* (DEs) because in most cases learners would respond by giving *textbook procedural definitions* (TPDs) which Ms Tulane accepted without probing for the TDDs. There were only two attempts of *descriptive responses* (DR) from learners and one from the teacher while most were *procedural responses* (PRs) suggesting that the teacher was using both the TPDs and TDDs types of definitions. This means that the teacher made learners receive the definitions of the terms procedurally at *interpretive response level 2* (IR2) and conceptually at *interpretive response level 3* (IR3) respectively. At IR2, the teacher was enacting a "Calculational Discourse" (Setati, 2005b), i.e. embedding definitions in calculation methods. While at IR3 the definitions were embedded in explanation methods of giving the definition of the term by describing it, enacting a "Conceptual Discourse" (Setati, 2005b).

At most the teacher made learners access terminology through procedural explanations. This was so because there were 23 procedural questions which got 24 procedural explanations and 17 procedural responses out numbering the 9 descriptive questions which received 3 descriptive explanations and 2 descriptive responses (see Appendix G). Most learners' responses were procedural. Procedural demonstrations helps learners understand underlying mathematical principles in the terminology and thereafter understand the meaning of the term (Ball, 1990). The teacher also enhanced conceptual understanding (Kilpatrick et al., 2001) because she persistently asked descriptive questions to enhance relational understanding of those terms (Skemp, 1976) even though they would receive procedural responses. This implied that the teacher promoted learner's procedural development in the procedural Discourse and the conceptual development in the conceptual Discourse so that they are able to show their understanding when it comes to reasoning and arguing out their thinking.

Therefore, Ms Tulane enacted both the procedural DD and the descriptive DD in her terminology explanations. And in this, the teacher legitimized both the procedural IR2 and descriptive IR3 definitions of the terms whose source was a textbook.

The use of the textbook as a textbook-in-use and as a source of definitions was a DD practice insuring conventionality in the definitions. The teacher would encourage learners to read from their textbooks and to refer to their textbooks now and again in the lessons which could be interpreted as a way of bridging learners' mathematics literacy gap (Bohlmann & Pretorius, 2008). She would ask the learners to always bring their textbooks to school, a DD practice she performed to ensure learners' use of the textbook in their learning of conventional definitions.

6.3.8 Languages-in-use

Ms Tulane used both the *ordinary language* (OL) and the *mathematical language* (ML) in her explanation of terms. She used OL to control the class and to give instructions to the learners so that every learner gets the instructions clearly and ML, mainly when explaining or talking about the terms.

It is through language and the use of that language learners develop the ability to learn and to construct meaning, therefore, the teacher talk is important because learners model teacher's use of language. Learners must hear and use the mathematical language in order to improve both their confidence and language abilities in mathematical communications. Language promotes classroom shared conversations which in turn develops a sense of class identity and community which motivates learner participation.

Using ML in the explanation of terms was also a very important DD practice the teacher performed. It was important because this language is the one used to convey mathematical ideas and if learners poorly grasp it, it is believed that it becomes a major source of underachievement in school (Cuevas, 1984). Therefore, the teacher was to accompany learner access to mathematics terminology with mathematical language skills for a complete mastering of mathematical terminology/concepts.

The use of mathematically structured *incomplete sentences* (INCS) is a DD practice in which learners were meant to complete the sentences using ML. This seemed like an encouragement in the use of ML and the development of learners' confidence in using it. The teacher also used *gestures* (G) and *expressions* (E) as body languages to accompany verbal utterances in the explanation of terms. This is a DD practice in the use of Grammar 2 accompanying verbal communication (Gee, 2005). Therefore, gestures and facial expressions were a form of communication the teacher approved in the explanation of mathematical terms. For example, when Joy and Peter used hand gestures as they were talking, (see lines L2:30, L2:31 and L2:37 in Appendix A), the teacher did not condemn the behaviour instead she still acknowledged Joy's communication.

Meaning is shared and negotiated with other people through language; therefore, language is social in nature. Vygotsky (1962; 1986) and Gee (2005) argue that language is an important tool in the acquisition of knowledge and understanding. Since language provides a means of interaction in any social context such as the mathematics context, the teacher allowed *home languages* (HL) to be used by learners in their group discussions of mathematical terms. A DD practice allowing learners use home languages in socially shared understandings. The main home language learners were using was isiZulu. Vygotsky (1978) argued that the structure of thinking is strongly influenced by language and because language is a social aspect, the teacher allowed learners to use their home languages to show their thinking to promote cognitive growth. Cognitive development is a process which can take place in a social context.

6.3.9 Learners' prior knowledge and homework

Ms Tulane used the previously given work to introduce the lessons. She gave learners *homework* in preparation of the next lesson. She then used the knowledge acquired from the homework as learners' *prior knowledge* and *recapped* that *knowledge* to introduce the lessons.

Giving learners homework is a DD practice which was very important in the explanation of terms because it helped the teacher to lay a continuous platform for learners' access to terminology by recapping their previous understanding. In this, Ms Tulane was working with the prior knowledge as baseline assessment of her previously taught terminology in the explanation process of mathematical terms according to the National Curriculum Statement of South Africa (DoE, 2001).

Paschal, Weinstein and Walberg (1984) argue that homework has a positive effect in learners' learning. Therefore, Ms Tulane gave homework as one of the effective practices which she used to facilitate learners' access to terminology, thus promoting a continuous process of explanation of terms and building up on learners' mathematical understanding of these terms.

6.4 Conclusion

This chapter presented the discussion of the results. The discussion has revealed that the teacher enacted the major and minor, common and uncommon Definition Discourse practices. During the commencement of this study, as a researcher, I expected the teacher to employ certain practices which I assume are major and common. Among these are the chalkboard use, question and answer pattern, the textbook use and the consideration of learners' prior knowledge. Instead the teacher was found to employ some of them more than just common. Among the major common ones, she employed the chalkboard use which she extended to the uncommon use of it being a thought pad as discussed in the discussion above. She employed group work and extended it to collaborative effort output instead of groups of individual effort output. She used mathematical language and insisted on its use by the learners through her incomplete mathematical sentences which were meant to be completed by the learners.

The analysis showed that the teacher also practiced minor common and uncommon Definition Discourse practices such as verbal utterance of terms, acknowledging learners' ideas, controlling the class, accepting chorus responses and accepting blurting behaviour among others as shown in the table of summary Table 6.1 above. Among these, the uncommon one is the acceptance of the learners' blurting behaviour by the teacher. There was a distributive thinking in the practices by the teacher.

In the next chapter I present the conclusions, implications, recommendations, reflections and limitations of the study.

Chapter Seven
Conclusions, Implications, Recommendations, Reflections and Limitations

7.1 Introduction

This chapter presents the conclusions that were reached in the study. It discusses the implications and recommendations for teachers when explaining mathematical terms. Also discussed in this chapter are the limitations and the researcher's reflections of the study.

Since the purpose of this study was to investigate how teachers facilitate learners' access to the meaning of mathematical terms in multilingual classrooms in South Africa, the following conclusion is hereby highlighting how the critical research questions helped the researcher to investigate the teacher's practices in the definition of mathematical terms. The critical research questions which guided the investigation are as follows:

1. How are the mathematical terms explained to learners in multilingual classrooms in South Africa?
2. What resources does the teacher use to explain mathematical terminology?
    a) Which languages does the teacher use to explain the mathematical terms?
    b) What artefacts being used to explain the terms?
3. What Discourse practices are involved in the explanation process of the mathematical terminology?

7.2 The Conclusions of the Study

The study undertook an investigation of a teacher's practices in the facilitation of learner access to mathematical terminology. From the analysis in Chapter Five and the discussion in Chapter Six, there are some major practices of the Definition Discourse which the teacher enacted and which constitute the Definition Discourse of a multilingual class.

The findings of the study have enacted the following 'tree' picture of a DD in a multilingual classroom in South Africa.

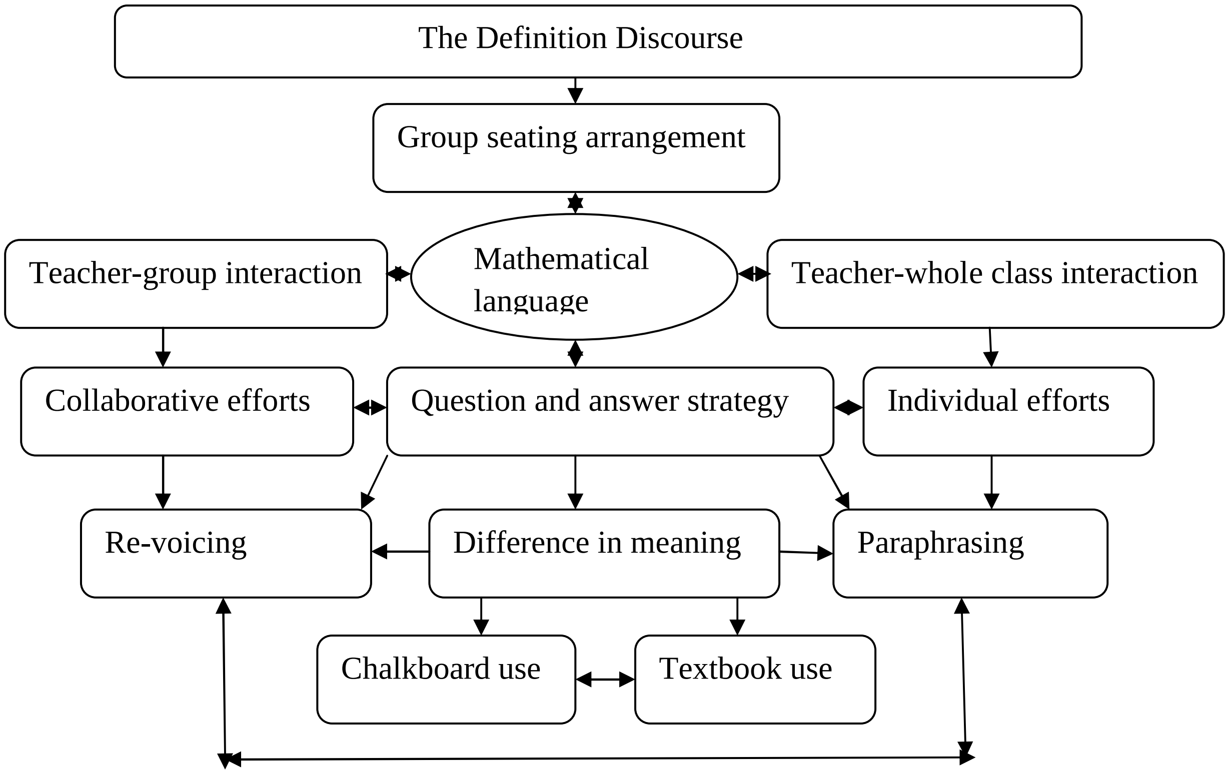

Figure 7.1: A skeletal view of a DD's major practices.

Below is the full explanation of the major and some of the minor DD practices.

The explanation of terms takes different pedagogical forms:

> **First,** the organization of the class seating arrangement is designed for particular forms of teacher-learner interactions. The seating arrangement is in groups but the interactions are two-fold – the teacher-group interaction and the teacher-whole class interaction. The teacher-group interaction is where the teacher interacts with learners for learner collaborative efforts and teacher-whole class interaction is where the teacher interacts with individual learners while seated in the groups. Learners in these interactions express answers of the group or of their own and both are of the initiation-response-evaluation (I-R-E) pattern (Scott et al., 2006). The teacher insists on group responses in the former and does not insist on a group response in the latter.

Making collaborative learning a successful reality in class is very important; it makes learners experience a process of disciplined enquiry that links their own ideas to the text in a truly open-ended way through group discussions. During the class discussions the teacher expressed a controlling voice, focusing learners' ideas and contributions on the task revealing group leading skills which maximizes learning and minimizes learner conflicts. Running group work learning pulls together learners' expertise with respect to the task, thereby bringing a more complex understanding than that of individual efforts. In this, learners are made to refine and extend their ideas beyond individual limits and thus receiving a supportive effect to develop group inquiry skills which are important in their learning.

In both interactions the chalkboard is used as a 'thought pad', i.e. learners' responses whether right or wrong are written on the board for everyone to see and internalize. During the discussion of the definition, constant reference is made to the work on the board until it is clear to the class as to whether the response is the legitimate one or not. The thought pad provides a healthy mathematical discourse on which learners are able to build confidence and judgmental skills on whether they are on the right track or not while working on mathematical terms. It helps learners see their thinking and promotes their learning (Graber, 1990); therefore it maximizes learner access to mathematical terminology.

Secondly, the teacher facilitated the above teacher-learner interactions through a question and answer strategy (Lobato et al., 2005). Through question and answer teaching strategy, the teaching and learning process becomes an iterative and interactive process. Explaining mathematical terms through asking questions, turns class discussions into explanatory conversations where the class shares the same understanding and commitment to terminology accessibility. These explanatory conversations can then be used to assess learners' terminology quality (Ross & Bruce, 2007) i.e. evaluating learners' understanding of terms being explained.

Thirdly, is the difference in meaning of the terms, a strategy which can be designed to empower learners with the understanding that some mathematical terms are better defined by explaining what they are with the help of what they are not (Marton et al., 2004; Runesson, 2005). Albeit, the teacher did not use difference in meaning for each term in the explanation, it gives learners an understanding that some terms have associated terms which can be used in the explanation even though they do not render the same meaning with the one in explanation. Having sufficient knowledge about the terms and the behavior of learners when they are faced with terms of different meanings (Adams, 2003), this strategy gives sufficient precision to ensure that each term has a determinate value to learners (McGee, 1997) i.e. greatest amount of meaning to learners (Pimm, 1991).

Fourthly, the teacher used the textbook. Although the explanatory power depends on the teacher's knowledge around what she is explaining, the most important aspect in that process is the source of meanings being used. During the explanation of the mathematical terms constant use and reference is made to the textbook. A textbook helps learners to link their ideas with the required texts and be competent in national assessments as it guarantees conventional formal meanings of terms. Though learners were made to access meanings of the terms both procedurally and descriptively, an explanation of a term is the one that comes to be and continues to be (Grosholz & Breger, 2000) all the time; therefore, using a textbook gives explanations of the terms which will ever be. Also reading from it, equips learners with the mathematics literacy about the term which is needed in the mathematical communications they might be involved in, and with time, acquire and appropriate the terms as their own (Vygotsky, 1978).

One of Mukucha's (2009) findings is that learners lack procedural fluency and conceptual understanding when it comes to mathematical reasoning and arguing. The present study shows that the two concepts of understanding are very important in the teaching of mathematical terms. The procedural understanding helps learners understand underlying mathematical concepts in the terminology and thereafter understand the meaning (Ball, 1990). The conceptual understanding helps learners develop relational understanding of the terms (Skemp, 1976), for example, relational understanding in the terms' associated terms and in the difference in meaning of the terms. Both concepts of understanding prepare learners for substantive mathematical communications they may find themselves involved in. These concepts of understanding come about with the use of the textbook in the explanation of mathematical terms and they bring about maximum clarity of mathematical terms' explanations to learners.

The **fifth** picture of a DD in a multilingual classroom is the mathematical language as the languages-in-use in the explanation process. From literature, Setati (2005), Kazima (2008) Webb and Webb (2008) and Setati and Barwel (2008) have argued that learners encounter difficulties in understanding the mathematical language that is why they perform poorly, while MacGregor and Price (1999) contents that learners may miss underlying mathematical concepts because they do not understand the language. The teacher provided incomplete mathematical sentences as 'language structured thinking statements' which may be used to train and teach learners to talk like mathematicians (Gee, 2005; Pimm, 1991) in their interactions. This language can then be used by learners as a thinking tool in the mathematical social context (Vygotsky, 1978; Gee, 2005). I then argue that a mathematical language-use in an explanation process of mathematical terms develops learners' mathematical language proficiency, thereafter, reducing those learners' language difficulties and maximizing learner access to terminology when it comes to uncovering the underlying messages of and about mathematics. Furthermore, it provides an opportunity to be used as a thinking, enquiring and communicative tool by learners when communicating mathematics.

It was observed that the teacher allowed learners to use their home languages in group discussions. This helps learners with difficulties in expressing themselves through the mathematical language to participate and bring their ideas to surface as they talk with others in the group. The language used to bring out the ideas can then be changed into a mathematical language in the collaborative responses. Therefore, home languages at this point, are used as resources in the teaching and learning of mathematics in a multilingual class (Setati, 2008).

The **sixth** picture of the DD in a multilingual classroom is teacher's re-voicing and paraphrasing of learner responses. Teaching of mathematical terms can be fused with re-voicing and paraphrasing which treats learners' contributions as appropriate pieces of information (Herbel-Eisenmann, et al., 2008). The strategy helps the class to hear what others would have said, though it may change the contributions slightly by reformulating them, it is a profitable strategy when defining the terms. It is helpful in that it makes the teacher's rebroadcasting reach a wider learner audience than before, thereafter, advances teacher's plan (O'Connor & Michaels, 1996). Re-voicing externalizes and clarifies the contributions for deeper understanding especially when the contribution is appropriate to the term's definition. While paraphrasing, as a teacher's provided responsive feedback to learner contribution (Pressley et al., 1989), is equally profitable in that it can maximize learners' access to mathematical terminology by its discouraging element of learner memorization through its positive influence to learner understanding. Both re-voicing and paraphrasing promotes the correct use of the mathematical language, learner understanding and precision in mathematical meanings because it is the teacher's responsive feedback.

Therefore, if there was poor performance by learners in mathematics due to difficulties in understanding mathematical language in multilingual schools in South Africa (Setati, 2005; Kazima, 2008; Webb & Webb, 2008; Setati & Barwell, 2008), it was necessary to investigate how mathematical terms (mathematical specialized vocabulary) were being taught to learners for accessibility to their meanings. The present study has given an insight into helpful Definition Discourse practices which can be used to help multilingual learners access mathematical terminology, as discussed in Chapter Six and in Section 7.2 of the study.

7.3 Implications

In this section the implications of the study, though in a more speculative way, will focus on three insights-

- The implications of the study for the teacher-led learning;
- The implications of the study for curriculum and
- The implications of the study for research

7.3.1 Implications for teaching and learning

According to the Definition Discourse discussed in this study, teachers on one hand are expected to move learners from their everyday understanding of some of the terms with two meanings (i.e. in ordinary language and also in mathematical language) to formal mathematical understanding of those terms (Adams, 2003). While on the other hand they are expected to bring learners to a clear understanding of specialized mathematical terminology which is not found either in their everyday understanding or ordinary understanding (Adams, 2003). Therefore, as Setati (2008) asserts that learners' home languages are a resource in the teaching and learning of mathematics, equally, mathematics teachers should accept learners' everyday and ordinary understanding as resources in the explanation of mathematical terms. For example, the teacher in the study used learners' prior knowledge as a resource in the explanation of mathematical terms.

In order to meet the requirements which enable this movement from everyday and ordinary understanding to more mathematical understanding teachers should use a variety of questions. This means that teachers are expected to structure questions which can help reveal learners' mathematical thinking and allow for further mathematical development in their created classroom conversations. For example, the teacher in the study used procedural, descriptive and leading questions to solicit information possible in the explanation process. By so doing teachers can promote mathematical communications skills and mathematical identities in learners and also help them develop mathematical argumentative skills for their flexibility in the Definition Discourse.

The use of the chalkboard as a 'thought pad' can be helpful to mathematics teachers in the teaching of mathematical terms. Teachers' presentations can be made by writing the terms on the board for every learner to see how they are spelt as they pronounce them. Graber (1990) argues that learners learn effectively by seeing. Teachers can also allow learners to write down their contributions on the chalkboard if they cannot verbalise them. This can help to bringing learners' attention to what they are supposed to focus on and also help teachers to accommodate both introverts and extroverts in class conversations

Without ignoring Brodie's (2007) warning about the strategy, teachers may need to examine the question and answer strategy. The strategy might be very useful in their classes and may need to use it even though it is a teacher-led. Its good part is that it is effective when a variety of question types is used. Instead of questions which seek a predetermined answer, the teacher can use learner responses to start a conversation and instead of those which seek correct answer only, the teacher can use open-ended questions to avoid teacher telling strategy (Lobato et al., 2005). Terminology accessibility by learners could be made possible by the use of different types of questions, for example, the use of descriptive, procedural, probing or leading questions and carefully listening to learner idea. Accepting learner ideas clear or unclear, probing learners for clarification of those ideas, supports learners' ability to communicate their mathematical thinking (Moschkovich, 1999). Therefore, the use of question and answer strategy understandingly might be of great results.

As we teach to meet the requirements of national examinations, the use of classroom textbooks is very important. Therefore, teachers' source of definitions needs to be the textbook in order to meet the requirements. A classroom textbook is the mostly available source of definition for the learner before a dictionary or a computer in addition to the teacher because when providing learning materials among the first things schools are expected to provide, are the textbooks (by whatever means). Therefore, teachers should use textbooks as their sources of definition so that when they ask learners to go and read from the textbook they are sure every learner has an access to it. Also, allowing the learners to use the textbook all the time enables the learners to refer to the textbook every time they want to confirm or refute the definition of any term in discussion.

The study has shown that group work within the mathematics classroom gives learners an opportunity to help each other by sharing ideas. Therefore, teachers can use this as an advantage to conduct collaborative work in their classes while they take positions of helpers and guiders.

7.3.2 Implications for the curriculum

Lack of proficiency in the mathematical language has been associated with poor performance of learners in mathematics in multilingual schools in South Africa (Setati, 2005; Kazima, 2008; Webb & Webb, 2008; Setati & Barwell, 2008). The curriculum should therefore, emphasize on the importance of understanding mathematical terminology as a key aspect in the teaching and learning mathematics at all learning levels and provide the *Teaching and Learning Support Materials* (TLSM) where possible to help teachers execute their duties in a manageable and learner helping way. Although the curriculum emphasizes on mathematical knowledge construction through establishment of descriptive relationships and its development and contestation through language (DoE, 2005), it did not emphasize on the framework in which teachers are expected to work within. Therefore, a framework in which teachers are expected to help and guide learners in their mathematical terminology construction should be spelt out.

7.3.3 Implications for research

This study outlines and defines the Definition Discourse in a mathematical classroom in a township in South Africa. It shows how a teacher's practices in the explanation of mathematical terms relate to the Definition Discourse and it gives an insight into the practices which were enacted. The Definition Discourse is emerging as a programme of thought and an area of concern which needs critical perspectives and therefore, opens to exploration. Exploration can be geared towards mathematical classrooms in rural schools settings still in South Africa, focusing on the learners' understanding and retention in the Definition Discourse.

7.4 Recommendations

In an attempt to improve learner access to mathematical terminology with the aim to improve learner terminology proficiency, teachers should provide a platform for the acquisition of both procedural as well as descriptive definitions of mathematical terms. In so doing, an improvement in learner mathematical achievement can be realised.

Teachers should not only use the textbook as the source of definitions in mathematics, but also use other sources such as other texts which are not necessarily mathematics texts so that learners have something to compare the textbook definition with. This will help learners to know the correct and actual mathematical definitions if they are also exposed to what they are not (Marton et al., 2004).

Mathematics teachers should allow learners to use the chalkboard during the lesson, especially for writing down their thinking about the definitions of the terms being discussed so that a whole class discussion is possible. With the definition of a term written down on the board by the teacher or learner, it is possible for other learners to inquire about the definition and hence access the definition of the term.

Though group work strategy can create noise and indiscipline in classes at times (Li, 1998), from this study it is worth trying because one of its advantages is that when there are learners in the class who are struggling to define mathematical terms other learners can help them as group mates to access the meanings of those terms, with the guidance of the teacher. Teachers are advised then, to skilfully plan group work activities. By making well structured and motivating group activities, unnecessary noisy talk by learners and opting sitting idle by some can be avoided.

7.5 Reflections

A lot was gained from this research. When I started this research I had no clue as to what a research design or research method is. I could not give the difference between the two; my supervisor had to intervene with the understanding that a design is the approach while the method is investigation. This was one of the important opportunities the study presented me with.

I found out that the backbone of research in educational researches is the theoretical framework; I struggled to bring my theoretical framework to a clear standard. Many times my supervisor would not get it when I thought this time I have made it to the expected standard of a theoretical framework. I then understood it through the hardest way of bringing other researchers' notions into my research as a theoretical framework of which the present knowledge of what it is has made me and will make me help others in the same area, an added skill to the acquired research skills.

Following the struggle in the formulating of the theoretical framework was the struggle in the formulating of the analytical framework. I was surprised to learn that a research has two important frameworks. After healing from the pain I went through in the first framework I found that the struggle in the second framework was doubled. The healing was brought about by the enjoyment I experienced in the literature review and part of research methodology and design. Because of this experience, I had told myself that the hardest part of the study was done with and did not anticipate that the analytical framework was more difficult to come up with. The struggle was doubled because the analytical framework is the researcher's development according to what she is researching though with the help of the available analytical frameworks of other researchers. In this second struggle the only motive behind coming up with a sound analytical framework was the first struggle's fruitful results of a sound theoretical framework. Another research skill acquired. These two areas of this study were the most difficult ones and today the knowledge acquired about and around them is the hardest to forget.

It was an enjoyable exercise carrying out this investigation. It gave me the understanding that in one instance's collected data there is a lot of information which can be used for several researches answering different research questions and there are many mathematical Discourses being enacted in that instance. When I started this research I viewed a Discourse as one instant of a practice happening independently from other things, for example, writing the term on the board or using a textbook, yet a Discourse is a set of things happening together in a setting. A Discourse is not a 'unit' with a clear boundary, it is a 'kit' of related accessories (Gee, 2005). According to Gee (2005), Discourse is in twofold: a Discourse with upper case and a discourse with lower case. He defines the Discourse of the upper case as ways of combining and integrating language with other 'stuff' that are not language in building recognition and of the lower case as language-in-use or stretches of language. My perception of a Discourse as of now is that, Discourse is an umbrella term of related concepts such as language, communication, interaction, 'society and culture'. It does not have a definite definition but usually refers to a form of language use and ways of speaking.

From the classroom observations, I have learnt that alongside mathematical terms' explanations, the teacher needs to develop group work skills, learners' write-up skills and learners' reading skills to enable deeper and retentive understanding of what is being taught. As for group work, when I saw learners seated in groups I thought it was a deceiving kind of strategy which gives an idea that the teacher is making learners work in groups while performing individual learning. This was not as I thought, throughout the observations the teacher's one of the strongest teaching strategies was group performance and in all the lessons she insisted on group effort responses.

There was a great deal of teacher practices in this study though some of them were not discussed in Chapter Six but were analysed (see Appendix E). As it was a multilingual setting it might be that the teacher was tolerant with the learners that is why she integrated a number of Definition Discourse practices as observed, which may not be applicable in a monolingual setting. Although it is beyond this study's scope, a monolingual setting might call for a lesser integration of Definition Discourse practices than a multilingual setting. Therefore, this opens for an exploration in the comparison of Definition Discourse practices integration in the two settings.

This study has intensely explored the critical research questions in its data analysis and presentation of results chapter. Most authors' views or ideas on teacher's practices in mathematics teaching and learning flowed fairly well with my findings, for example, Franke et al. (2009)'s findings on the chalkboard use as a directing mode of class' talk and thinking. It also showed that the selected research methods used were successful. The research has confirmed that there are effective practices a teacher can employ in order to bring about learner access to mathematical terminology.

I also learnt that it takes all the available strength to be a researcher, a profession very difficult to come by.

7.6 Limitations

Although the HOD solved one major problem by volunteering to participate when the intended participant declined the agreement as mentioned earlier in Chapter 3, there were still other problems. In the discussion with the first intended participant the agreement was that he will be introducing the chapter on The Averages of Dispersion in the Grade 11 class by the time the observations were to start and I was assured of getting new mathematical terms being introduced. This was not the case in the HOD's lessons because she had already introduced the topic and was in the explanation process of the already introduced terms. This made me use instances where the terms were defined and in some cases where the teacher had no intention of defining the term, I was tempted to use my own discretion. Owing to the participant not intending to define terms, it was very difficult to glean instances where explanation of terms was taking place during data analysis. Being human this had a tendency of leading me into biasness of choosing what I wanted to hear, see, accept and prioritize both in the observations and in the data analysis.

Interviewing skills are not guaranteed. There are features in the interview which I feel were not done correctly and if I were to conduct the same interview again, I would do them differently. Though the interview transcriptions showed that there were a lot of relevant data collected, the interview questions were more of essay questions than interview questions. This was discovered during the interview when the participant was made to talk too much giving a long talk in her answering of each interview question (see Appendix B). Such questions can upset the interviewee and can make her lose concentration on her responses (Opie, 2004). Because of such questions the participant's responses were too long that I had to develop information sieving skills in order to select appropriate areas which would answer my research questions in the data analysis. Therefore, if I were to conduct the study again I would fragment the present interview questions into short questions asking for precise responses.

Also, because of its qualitative nature it focused on one teacher in a Grade 11 class, which could imply that:

- The teacher's practices were exclusive to her environment and experiences because different teachers enact differently in their classrooms, therefore, the results cannot be generalized to all Grade 11 teachers in South Africa (Opie, 2004).
- Consistency of the results cannot be assured because my observations cannot be another researcher's observations on the same phenomenon with a different participant, though using the same instrument (Lincoln & Guba, 1986).
- Consistency of the results cannot be assured if the study could be repeated by another researcher because my biases due to more personal understanding of the transcribing

process than general could have led me into choosing what I wanted to consider in my data analysis (Cohen, Manion & Morrison, 2002).

However, the purpose of this study was not to generalize but to understand and learn from it the teacher's practices on how mathematical terms can be made available for learners to access them.

7.7 Directions for Further Research

This study was conducted in one school with a sample of one participant and the findings were not for statistical presentations. This may influence a need for a similar further research on a large sample to enable generalisation of the findings.

Both procedural and descriptive understandings were observed being made available to learners though the descriptive ones were to a lesser extent, it is not known how much retention does either renders in learners when it comes to performance. Therefore, a research may be directed to an investigation on the effects of procedural understanding of mathematical terms, IR2 versus the descriptive understanding, IR3.

The idea of associating multilingual learners with poor mathematical performance (Setati, 2005; Kazima, 2008; Webb & Webb, 2008; Setati & Barwell, 2008) seem to show that these learners do not readily get the mathematical terminology right compared to the other sector of English first language learners. Although findings around this concept were unearthed in this study, it possibly provides a potential call for investigations on this other sector of English first language learners' mathematical performance and on their readiness in getting the mathematical terminology right. This will give a better platform for comparison of learner performance in mathematics learning.

7.8 Concluding Remarks

This chapter presents the Definition Discourse diagram which when turned upside down; it gives a picture of an upright tree with its roots, a trunk and branches, therefore, I term it a Definition Discourse 'tree' diagram. The tree is almost vertically symmetrical showing a balancing picture of practices the teacher enacted in the DD. The chapter's explanations about this ‘tree’ diagram are the conclusions of the study. What follows the ‘tree’ explanations are three focused insights as implications of the study; a focus on teacher-led learning, a focus on the curriculum and a focus on research.

The chapter indicates that there are areas and clues to consider when teaching within the DD and these were given as recommendations of the study. The researcher’s acquired research skills were given in the reflections, while shortcomings on the researcher’s side and of the study are discussed in the limitations of the study. The chapter also presented the direction for further studies making the story this study was telling coming to an end.

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Appendices

Appendix A: Lessons 1, 2 and 4 Transcripts

Lesson One: Transcript

Speaker	Utterance
L1: 1 Teacher	[When the teacher and I entered the classroom, most learners were making noise, and those who were not sited ran to take their places, some learner went and rubbed the board and came back to join the others. The teacher walked around and learners were seen putting away some non-mathematical items e.g. books, and sat quietly in groups facing the board waiting for the teacher's opening instruction of the lesson. The teacher went in front far right and spoke]. I gave you some data to go and study, and you were working in groups so each group should tell us what they did, ok. What did you find from the work I gave you
L1: 2 Learner	The range
L1: 3 Teacher	Ooh he is saying the range, what he has found out is that there is a range there. So range is there, is the range part of the five number summary, yes, no
L1: 4 Class	No
L1: 5 Teacher	Okay let's just write it even though, because that's what he has learned about [writes the term 'range' on the board], saying the range, how do you define the range, what is the range
L1: 6 Class	Highest score minus lowest score
L1: 7 Teacher	Ok, I will separate whatever you give me, tell me whether it falls under the five number summary, right, what else, Joy
L1: 8 Joy	No idea
L1: 9 Nicho	We only look to three first quartile
L1: 10 Teacher	Three, why three and not...[with a surprised face]
L1: 11 Nicho	Quartile, it's the lower quartile which is the median of the first half
L1: 12 Teacher	Lower...

L1: 13 Class	Quartile
L1: 14 Teacher	What's the abbreviation of the lower quartile
L1: 15 Class	Q1
L1: 16 Teacher	Q1 [writes Q1 on the board] okay and the other one?
L1: 17 Class	The median
L1: 18 Teacher	The median, right median the abbreviation
L1: 19 Class:	Q2 or M
L1: 20 Teacher	Q2 or M, This one [pointing at M on the board]
L1: 21 Class	Yes
L1: 22 Teacher	Which is the median, what is the median, who can define for us, [looking for a volunteer] let's go back a little bit
L1: 23 Learner	The number that divides that divides the data into two parts, right [asking if he was right]
L1: 24 Teacher	Right, it is the middle value of that data when the data is arranged in order of size, right, [paraphrasing learner's utterance] Next what is the third quartile
L1: 25 Class	Upper quartile
L1: 26 Teacher	Upper quartile [writing on the board] how do we abbreviate
L1: 27 Class	Q3
L1: 28 Teacher	Q3, okay how many do we have now [pointing to the work on the board]
L1: 29 Class	Three
L1: 30 Teacher	One, two, three, [pointing to Q1, M, and Q2] but what are we looking for [facial expressions and hands movements indicating that all what was explained was heading to an important key term or phrase]
L1: 31 Class	Five number summary
L1: 32 Teacher	Two outstanding values are...
L1: 33 Class	Minimum value and maximum value
L1: 34 Teacher	It is the minimum value and maximum value, right, I want us to look at exercise eight point six on page one hundred eighty nine, there it says... in your groups, the baker keeps (...) of number of dough nuts sold a day for three weeks, the numbers are (...) there is data that is listed there, they said find the range using the formula that the range is equal to highest score minus...
L1: 35 Class	Lowest score

L1: 36 Teacher	Right, I want you in your groups (...) on the data; find the range and the five number…
L1: 37 Class	Summary
L1: 38 Teacher	Five number summary in your groups, I will be moving in your groups checking , okay, what is the first step, what do you do [moving around the class helping the groups]
L1: 39 Many learners in one group	Arranging in...
L1: 40 Teacher	Arranging in...
L1: 41 Many learners	In ascending order
L1: 42 Teacher	Arrange the data in ascending order, quickly do that, why are you five in one group [insisting on four in a group]
L1: 43 Teacher	Who (...) okay what is the range, can you define range, if not yet understood [opening the hands with a sharp facial expression in surprise]
L1: 44 Class	Yes [nodding their heads in agreement of not getting the definition right]
L1: 45 Teacher	Quickly calculate it
L1: 46 Learner	Fifty two... the range
L1: 47 Teacher	What is the range here, what is the range, do you get range here, where is your book [checking learner's work]
L1: 48 Learner	It's forty five
L1:49 Teacher	Right, what is your range here, right people can we just summarise here, what is the range [going back to the board]
L1: 50 Class	Forty eight
L1: 51 Teacher	Forty eight, people did we arrange from the highest to the lowest, yes or no
L1: 52 Class	No
L1: 53 Teacher	No, because you will be wasting your time, look (...) find the highest score, find the lowest score and (...) move on, now number 2, we have the range there, what is the highest score there
L1: 54 Class	Eighty two
L1: 55 Teacher	Eighty two minus the lowest...
L1: 56 Class	Thirty four
L1: 57 Teacher	Which is [pointing at the data set on the board]
L1: 58 Class	Forty eight

L1: 59 Teacher	Forty eight, right who is done with number 2a, okay there is a hand [going to one of the groups], label lower quartile, so that you remember, eh next aah what's this, you must write quartile, median, range or... what? please don't just write anything you don't know, use both please, sometimes you find out that both of them (...) so don't summarise too much, next
L1: 60 Learner	Ihi forty six {its forty six}
L1: 61 Teacher	They say arrange after that number b [looking into the textbook]
L1: 62 Learner	*Sithole imedian, le ephakhati khuphela forty six* {We have found the median, the only one in the middle is forty six}
L1: 63 Teacher	The median number is the middle number which one is the middle number
L1: 64 Learner	Between sixty seven and sixty two
L1: 65 Teacher	Between sixty seven and sixty two (-) you say the median is between sixty seven and sixty two
L1: 66 Learner	Yes
L1: 67 Teacher	Which one is in the middle, okay let's check did you arrange in ascending order, so which one is your median then, okay lets count, count the data, count your scores there, how many scores do you have one two three four five [counting the scores together with the learner] seven so which one is in the middle
L1:68 Learner	fifty
L1: 69 Teacher	Its true fifty? [in disbelief] can you put your hand on top of fifty, count this side then that side, so let's just count seventy eight sixty seven which one is the middle number, you know what, your scores are not the same are you working as a whole group
L1: 70 Learner	Yes
L1: 71 Teacher	No [shaking the head], she got seventy six, she has sixty nine we don't have sixty nine, you are not working in a group, you must discuss as a group, you see, let me see, seventy eight, sixty nine and which did you add extra it seems you have other one extra, so you see that's why the median is not the same, so how did you define the median, you say the median is the middle number, what does middle mean
L1: 72 Joy	Number in between
L1: 73 Teacher	In between what, you said your median is what?
L1: 74 Joy	Number in between the one this side and the other that side
L1: 75 Teacher	But you did not write it here, you have written sixty seven what is (...) or we want sixty seven and sixty two, right let's discuss in groups, two minutes what is the median and give me your answer (...) not at all, the other thing you must write is a median in brackets Q2, in brackets Q2 (...), right next, Q1 what is Q1, the first quartile and the minimum

	value, are they the same
L1: 76 Joy	No
L1: 77 Teacher	You have written Q1 (...) are you working as a group, you must work as a group, so discuss, what is the difference between first quartile and minimum value, third quartile and maximum value, okay, can I check your median, what is this, right median (...)
L1: 78 Joy	Q2
L1:79 Teacher	But you have not written anything for today, remember you are all learners no spectators, you must write, eeh I'm coming there, lower quartile, the median is correct, you say three to one... *ja* [yes] you have to write it down, after two months you would have forgotten, next, lower quartile
L1: 80 Learner	Three numbers after (...) find the lower quartile, the next Q1 okay between Q1 and (...)
L1: 81 Teacher	You understand now, you have divided the data into...
L1: 82 Peter	Four
L1: 83Teacher	Four *ja* {yes}
L1: 84 Peter	*Ihi forty six* {its forty six}
L1: 85 Teacher	When you divide data into two parts then you get the median from there, take the first half, find the middle quartile, find range, lower quartile, upper quartile , people write in full in your books, when you study you need to understand it, don't summarise here, write it in full [silence]
L1: 86 Teacher	Right, any group which have done the stem and leaf I just want to check the stem and leaf now, there, there in that group
L1: 87 Brenda	Here [raising hand up]
L1: 88 Teacher	Stem and leaf how did you get this, right thirty two divide by two now, what is the median?
L1:89 Brenda	Number between numbers 36,6
L1: 90 Teacher	Okay 36,6 okay can you count your data here, in the stem 10, good, can you arrange stem and leaf in a correct way, where is my pen, I left it
L1: 91 Brenda	*Hasifuni lawa mafour four asiarrange ne* {we don't like these four fours let us arrange them, ok}
L1: 92 Teacher	And then first quartile, *le* {this one} right do the discussions, eeh Brenda you must remind your group mates, they must label, don't just write eeh, also they should label that it is a stem and leaf, *ja* {yes} good uh is this quartile two

L1: 93 Brenda	No
L1: 94 Teacher	You see you must always check, Simon this is not quartile two, it is three, quartile two is there, divide your data into two, take the first half divide into two, take the other half and divide into two again so that you get your quartile two, so please be careful okay, next stem and leaf
L1: 95 Learners	*Le* {This one}
L1: 96 Teacher	Right you have only done the median, something, what is this twenty three for, lower quartile, range, okay for number two eeh what do we have [to the class], you are supposed to do stem and leaf for number three, (...) you are rectifying number two
L1: 97 Brenda	Yes
L1:98 Teacher	When did you do it (...) with stem and leaf
L1: 99 Learner	No, we did it there, stem and leaf *le* {this one}
L1: 100 Teacher	Okay, you see that's why it is confusing, when you were writing you labelled it number 2, that is number three okay, continue doing the first quartile, third quartile, for number three, using stem and leaf, you can also do the next. Okay people, time up, go and finish your work and read again on quartiles in your textbooks to understand them see you tomorrow. [Learners run for the next lesson and we left the class last].

Lesson Two: Transcript

Speaker	**Utterance**
L2: 1 Teacher:	[The class monitor had collected and handed out learners' marked group work just before the lesson had started. Therefore, when we entered the classroom the noise which the learners were making was that of discussing their marked work, but as we entered the classroom the learners kept quiet with the few who were still standing getting sited in their usual places. The teacher stood this time in front but far left and talked to the learners]. Which group can present the stem and leaf of the data from previous work, Thabo
L2: 2 Thabo:	[Goes to the chalk board, draws a stem and leaf on the board, writes an incorrect spelling of the word 'stem' and the class corrects him], *ngu number bani lapha* {what is the number here}
L2: 3 Class:	*Kunye, kubili, kubili* {one, two two}
L2: 4 Thabo:	*Kuthathu, kuthathu, kuthathu, kuthathu, Kuthathu, kune, kuhlanu* {three, three, three, three, three, four, five}}[writing on the board]

L2: 5 Teacher:	Eh people I would say (…) you don't say one, two. three you would rather say eleven, twelve, thirteen just to use the correct numbers then, that way helps you to remember this, you then say twenty one, twenty three, okay
L2: 6 Class:	Fourteen, fifteen, sixteen, seventeen, eighteen
L2: 7 Nicole:	*Ehe wena awuyibalanga* {you, you did not write it}
L2: 8 Teacher:	How many scores are there?
L2: 9 Class:	Twenty four
L2: 10 Thabo:	[counting the scores to verify] *ja* {yes} twenty four
L2: 11 Teacher:	Right, thank you, your next question, Brenda
L2: 12 Brenda:	I started like finding the mean of the scores…
L2: 13 Teacher:	Scores
L2: 14 Brenda:	Three and four, I look for my lower quartile then I found its twenty three, then my median is twenty three plus twenty four divide by two because lower quartile is also median
L2: 15 Class:	No it is five
L2: 16 Brenda:	I find the median of the whole numbers, then I find the median of the half because median of the lower is the lower quartile
L2: 17 Teacher:	Please, please help her
L2: 18 Nicole:	*Unamanga, ayisi*, [You are lying, it's not] it's not twenty three; it's fifteen plus sixteen…
L2: 19 Teacher:	Eeh Joy what did you write, what is your lower quartile, how do you find the lower quartile
L2: 20 Joy:	I divided the positive two by two…
L2: 21 Teacher:	Right [with an encouragement hand gesture for the learner to continue]
L2: 22 Joy:	Then I find …
L2: 23 Teacher:	Remove the lower quartile, just do one thing at a time so that you are able to (...), good, eeh start with your median, remember we start with our median
L2: 24 Joy:	We divide our data into two, then we calculate the median
L2: 25 Teacher:	Right [encouraging again]
L2: 26 Joy:	Then I look for the lower quartile I found that its twenty three
L2: 27 Teacher:	Twenty three {re-voicing learner's utterance}
L2: 28 Joy:	Yes
L2: 29 Teacher:	How do you find the lower quartile tell us

L2: 30 Joy:	I jumped this number, then I got to [points at 3 in between 33 and 34 in row three]
L2: 31 Peter:	No, no [with flying hands and head shaking in disagreement]
L2: 32 Teacher:	Yes Peter [pointing at Peter giving him a chance to bring his idea]
L2: 33 Peter:	Eeh in your (…), I must do, this is your half of your scores *le* {this one} and then get the half of the half of your scores and then you say [counting the scores)] okay go straight to the half of the eleven, one, two, three, four, five, six, seven, eight, nine, ten, eleven, (...), then here you count again [counting again from one to eleven looking into the textbook] because your scores are given there, therefore you take two numbers to get your middle number and then add them and divide by two and its going to be sixteen plus fifteen then you get thirty one divide by two which is equal to fifteen coma five and that means end quartile
L2: 34 Stella:	Lower quartile
L2: 35 Peter:	Lower quartile
L2: 36 Teacher:	You understand Joy now, can you do the upper quartile for us
L2: 37 Joy:	Upper quartile, for the upper quartile, I'm going to take there second half [pointing at the data set on the board]
L2: 38 Teacher:	Good
L2: 39 Teacher:	Who wants to come and do the range for us, every time you come across questions try and do them on your own the other questions that we had gone through, Joe
L2: 40 Joe:	Yes, [coming to the board] the range, I find the highest number, for this one the range will be (...) because it is the highest number that is given here [pointing at the board]
L2: 41 Teacher:	Eeh yes Brenda, Brenda what is the range?
L2: 42 Brenda:	Forty six
L2: 43 Teacher:	And what is the inter quartile… [disagreeing with Brenda's answer]
L2: 44 Brenda:	Range
L2: 45 Teacher:	Range [nodding her head]
L2: 46 Brenda:	Fifty one
L2: 47 Teacher:	What was there [pointing at the data on the board], are you listening
L2: 48 Brenda:	Yes, the inter quartile range
L2: 49 Teacher:	Ooh you have done everything, right, now people any problems with other questions, did you encounter any?
L2: 50 Nicole:	Box and whiskers
L2: 51 Teacher:	Okay who can draw that box and whiskers for us on the board so that we can move on to (...), now you can move on to

	the next question, right box and whiskers who wants to come and draw it, can we have someone who wants to come and draw a box and whiskers who wants to come and draw the box and whiskers, okay Lerato wants to come and…
L2: 52 Lerato:	Try [goes to the board and draws a box and whiskers]
L2: 53 Teacher:	Try, okay that's why you are here, try, can I just check, how did you draw your box and whiskers because there is a problem, who doesn't understand, let me see, can I see what you have drawn, how you have drawn it, no Jackie, it can't be, what must I correct, you must draw it so that I can correct it [to the learner who had not drawn anything], [moving around the groups] each one of you (...), still okay, correct, okay, who else has got a problem with a box and whiskers, which group?
L2: 54 Stella:	Us
L2: 55 Teacher:	Which group, you, right okay let's look at what Brenda has drawn there, your five number…
L2: 56 Class:	Summary
L2: 57 Teacher:	With your box and whiskers, that's what you show, your five number summary then you say minimum value, lower quartile, medium, upper quartile and maximum value, right, so people try and draw it because most of you didn't draw it, okay I'm going to give you some five minutes to draw, but now people what we should do *ne* {ok} eeh try and use a scale, I will be coming to you and show you how to use a scale so that you can actually see whether your box and whiskers is symmetrical, is skewed to the left or skewed to the right
L2: 58 Stella:	Right
L2: 59 Teacher:	Okay, so you can draw it using a free hand, sit down, it looks symmetrical but if, people you must use a ruler try and do some scale, don't, now if you look at the eeh, Brenda has drawn box and whiskers using free hand. Right? The information is misleading because look at your box and whiskers there, box is symmetrical but if you draw it it's not symmetrical. Right? In other words the difference between the lower quartile and the median is not equals to the difference between the median and the ...
L2: 60 Class:	Upper quartile
L2: 61 Teacher:	So, let's use the ruler to draw a scale, okay draw, did you see what I did there?
L2: 62 Nicole:	No
L2: 63 Teacher:	Oh you have drawn it nicely, let's see, *ja* {yes} good but you must label, please show them, label, don't put five there, put five number summary, okay next group, they are fine, you are also fine, I expect everyone to be drawing, people remember I told you, (...)
L2:64 Class	Yes

L2: 65 Teacher:	But it's always the same, right lets read here[looking in the textbook], some books when they talk about skewed, they are saying a symmetrical data set is balanced or you heard so, that it have to be exactly, exactly on either side of the median. Note that, it doesn't have to be exactly equal on both sides to be called symmetrical. This is good what you are doing, then calculate thirty three minus twenty three. It's what? Twenty three coma five minus fifteen, so I want you to read the drawing, you must read about symmetrical, skewed to the right, skewed to the left, when is your box skewed to the left, when is it skewed to the…
L2: 66 Nicole:	Right
L2: 67 Teacher:	But note about symmetrical, you don't have to get exactly. Do you understand?
L2: 68 Joy:	Yes
L2: 69 Teacher:	*Ja* {yes}, but then you must show the numbers, you know why you must show the numbers [referring to the box and whiskers on the board], because when I'm marking your papers I should be able to see that you know the minimum, don't write a lot of numbers, just show the minimum of the five number summary, show the lower quartile, show the median, show the upper quartile, show the…
L2: 70 Class:	Maximum value
L2: 71 Teacher:	Maximum value. Do you understand? So please people just go through the symmetrical data, eeh all of you today after you have drawn your box and whisker, can I have your attention please, after you have finish drawing your box and whisker just turn on page one hundred and ninety four and read there about skewed and symmetrical data then analyse your box and whiskers, is it symmetrical, is it skewed to the right, is it skewed to the…
L2: 72 Class:	Left
L2: 73 Teacher:	Right, people now let's move on to exercise eight coma ten, exercise eight coma ten, number one, in your groups, people you must draw those box and whiskers and then analyse the data, i.e. whether it is skewed or symmetrical, people just write on top there five number summary, stem and leaf (...), stem and leaf, five number summary, minimum value, maximum value, write everything to be clearer for you, you must write five number summary, bring your book so that I can mark. Sam! Where is your five number summary, still, write it here
L2: 74 Sam:	It is here.
L2: 75 Teacher:	*Ja* {yes} but why do you squeeze it here, just write it here, write it neatly here, the five number summary , write here five number summary here, Sam what are you laughing at, have you finished eight coma ten?
L2: 76 Sam:	No
L2: 77 Teacher:	So why are you laughing [continues explaining to Sam] so you write five number summary, no you must write, you know what, you must write in your book so that when you look at your information after three months it gives you correct

	information, because if it is just numbers like this after three months (...), what did you say, what is this, you will have forgotten about it, you must write five number summary, minimum value, maximum value, the box and whiskers, label it box and whisker diagram so that you remember what it is, and don't call it thing and thing and thing, they have got their names
L2: 78 Nicole:	They have given the scores
L2: 79 Teacher:	Eeh people exercise eight coma ten, *ne* {okay}, you have been given scores there as stem and leaf you don't have to re-write, right, already stem and leaf is giving you what, the…
L2: 80 Class:	The scores
L2: 81 Teacher:	The scores from the smallest to the…
L2: 82 Class:	Highest
L2: 83 Teacher:	Highest, do you understand, time management, hullo can I have your attention please, stem and leaf, your data already has been arranged in an ascending order okay, please time management it's also important because if you re-write things that are not necessary you won't finish the question okay, do you understand, so that data there is giving us stem and leaf, just calculate your mean, median, whatever is asked there, okay
L2: 84 Learner:	Yes
L2: 85 Teacher:	Right, don't re-write there, you should be finished by now, how to calculate the middle, the middle, calculate, lets read our data, this is twelve, thirteen, fourteen, fifteen, sixteen, this is twenty, twenty, twenty one, twenty etc
L2: 86 Nicole:	Yes
L2: 87 Teacher:	That's your minimum value, that's your maximum value, *ne* {okay}, so find the middle, divide the data into two, divide the data into two, uh, what are you calculating, uh no you don't have to add them you must count, just count one two three four remember what's this, this is twelve, thirteen, the first scores twelve, the second score thirteen, fourteen, fifteen, sixteen, sixteen, seventeen, do you understand
L2: 88 Nicole:	Yes
L2: 89 Teacher:	Where is your textbook, please bring the textbook to class all the time, you see now if you had your textbook, you would be comparing how many did you get, but if you count as one like this it is a problem if you are wrong you are both wrong, do you see, how many did you get
L2: 90 Nicole:	Thirty two
L2: 91 Teacher:	*Ja* {yes} have you found the median
L2: 92 Joy:	Yes

L2: 93 Teacher:	Okay, try to find the median and then discuss it, check if it is correct
L2: 94Nicole:	It's thirty five
L2: 95 Teacher:	It's what…
L2: 96 Nicole:	It's thirty five
L2: 97 Teacher:	Why is it thirty five
L2: 98 Nicole:	Half is sixteen
L2: 99 Teacher:	Sixteen, okay and thirty five, (-) okay let us see, you say half is sixteen, sixteen it means the first sixteen and the last sixteen, so let us talk about thirty two, thirty two, is it an even number or an odd number
L2: 100 Nicole:	Even number
L2: 101 Teacher:	So if it is an even number what do we do
L2: 102 Nicole:	We add the numbers and divide by two because we want to find the half of it
L2: 103 Teacher:	*Ja* {yes} you must take score number sixteen plus score number seventeen we add it together and divide by two, is it what you did, is it what you did [with a frontical gesture]
L2: 104 Nicole:	Yes
L2: 105 Teacher:	So which one is it
L2: 106 Mike:	Thirty five and thirty seven
L2: 107 Teacher:	Thirty five and thirty seven divide by…
L2: 108 Nicole:	Two
L2: 109 Teacher:	Okay, write it, you must write the formula median is equals to (-), you write the two numbers and divide by...
L2: 110 Mike:	Two
L2: 111 Teacher:	Two, okay
L2: 112 Mike:	Thirty six
L2: 113 Teacher:	Thirty six, write it, okay, don't just write thirty six, write median equals to, (-) now what's the formula for the mean, go back and check the formula, how did you write the formula, how do we write our formula…
L2: 114 Mike:	X bar is equal to the sum of...
L2: 115 Teacher:	Good, x bar is equal to the sum of all squares [writing the formula on the chalkboard]
L2: 116 Mike:	Yes
L2: 117 Teacher:	The mean not the median, this is the mean, why is it the mean not the median
L2: 118 Mike:	Yes, it is the mean because it is from the formula

L2: 119: Teacher:	*Yo yo yoo* {no,no,no} [shaking her head disagreeing with the learner] but how did you calculate the mean, ja {yes}, is it correct
L2: 120 Mike:	No
L2: 121 Teacher:	No, so how must you calculate the mean [hands gestures wanting to know how the mean is calculated]
L2: 122 Mike:	You must use this formula which is x bar is equal to...
L2: 123 Teacher:	Yes you must use this formula [pointing to the formula written on the board]
L2: 124 Mike:	Ok
L2: 125 Teacher:	Let us use our calculators, mode right, do you still remember that, mode...
L2: 126 Mike:	The steps or the number that is appearing the most because it is the mode of the numbers
L2: 127 Teacher:	Two
L2: 128 Mike:	This one [points at two on his calculator]
L2: 129 Teacher:	*Ja* {yes} two, then enter your scores, where are your calculators

Lesson Four: Transcript

Speaker	**Utterance**
L4: 1 Teacher	[We entered the classroom, this time learners were sited talking to each other but their voices were lowered. The teacher greeted the learners and ordered them to pull out their group past exam question papers and asked them to answer certain questions on statistical averages from those papers]. I want you to continue answering those questions from the exam papers, and then each group will present a solution of a question to the class. Stop concentrating on your book, we all have eeh question papers, this is one of the typical exam questions, I want you to answer them after you have discussed with people in your group, I will be back after twenty five minutes, okay
L4: 2 Class	Yes
L4: 3 Teacher	Try to select a person who is going to present, not all questions, I'm going to give a chance to each group to give us a solution to a question, Try as many questions as you can present. Are you discussing with your group? [leaving the class for a meeting]
L4: 4 Class	Yes

Appendix B: Teacher Interview Transcript

Coding of teacher interview

IQ – interviewer question

PR – Participant's response

CQ -critical question

Speaker	Utterance	Where the critical research questions are being attended to
IQ1	What do you consider as a better way of introducing mathematical terms to learners in your class?	
PR1	I think… is to assess where the learners are at first, what they already know about what I want to teach them…things like their prior knowledge, what they think the mathematical term I want to teach mean after saying and writing the term on the board. I normally ask them questions relating to what I want to introduce or if we had done the main topic and maybe the term I want to teach is in the subtopic I recap what I had taught them to lead to what I want to teach…what I have noticed with my learners is that when I write a mathematical term on the board which is not familiar to them they keep quiet and I know they do not know this term then, if it needs a diagram for me to illustrate the term I draw it and illustrate using the diagram. If I definitely know, during my planning, that the term I am going to teach is very new, I bring all the	**CQ1**.How are the mathematical terms explained Highlighted: Definition Discourse

	necessary resources such as models or charts if I have them. But sometimes when I write something on the board which they do have a clue about it, its normally shown by their facial expression…eh…I just switch to questions of wanting to know what they know about that. But for the topic I am teaching on five number summary (averages) I first asked the learners to bring their last term's marks from 13 exercises be it a test, homework or class work so that we could work on the marks as our data. Because we were looking at averages I just asked them to find their average mark of the list	practices
IQ2	Do you use informal knowledge or formal knowledge when introducing or teaching mathematical terms and why would you use it	
PR2	You know what, I use both informal and formal knowledge just like what I did when I introduced this topic I used their knowledge of general average…because when they show that what I have written on the board is known to them I assume it's informal or when I assume that they know something informally about what I want to teach I will ask them some questions and if I find that they have some correct mathematical definition of what I am teaching then it becomes easy for me to continue but I make sure I give them mathematical examples as I define and where and when the terms are used so that they get it straight and I ask them to write the definition in their books in such a way that they do not forget its mathematical meaning compared to other meanings. If the learners do not have any clue about what I am to teach I just go straight to formal mathematical meaning, though sometimes when necessary I use the	**CQ2.** What resources does the teacher use to explain mathematical terminology?

	informal… to help them understand if they are not getting it but I… normally go straight to formal mathematical meaning because I want the learners to get it straight from the mathematical point of view so that they do not mix ideas or the meanings and it is also easy for me to explain the terms…in a mathematics way as I understand them well that way.	Discourse with "D"
IQ3	Looking at the whole topic you are teaching what terms did the learners get straight and what terms did they struggle with? What could be the reason?	
PR3	The words mean, mode and range were understood quite easily and it was easy to find them than median and quartiles. I think they understood the first three because they are easy to calculate…for example mean is what they used to call average, mode being what appears most in their data and range I taught them to think of it as a distance between the starting point and the end point of the data though I was referring on the difference between the smallest and the largest value. Coming to the median and the quartiles, I think their difficulty for median was when the number of numbers is even they sometimes get a value which is not in their data so they get confused but when the number of numbers is odd the median is easy to pick because it appears to be the middle number and for the quartiles as percentiles…normally they want to get the percentages as (25%, 50%, 75%) to show that they are in quarters, they do not know that it depends on the data they have…they compare data which they will be working on with a set of consecutive numbers and maybe because they cannot link these words with any of their	**CQ2b.** What examples or metaphors are used

	everyday words so they do not readily get it.	
IQ4	Do you borrow some definitions of the terms from other sources e.g. other textbooks, life situations or other people's definitions (verbal or texts). Why?	
PR4	I use any source of information available which can help me to make the learners understand, you know, the type of learners we have here are not from rich families where we assume they might have resources at home or to think they might get some help at home, they only get school knowledge from us teachers and not from anywhere,…we really struggle to get them understand what we are teaching so I should be resourceful myself in order to help them…also our school is not equipped like other schools which have computers for learners to get information its only me here as a teacher who have access to a computer not learners. I use definitions of different sources for example when I was teaching them about the word data, for them to understand what data means I send them in their groups, and these are permanent groups in that class, to go and collect the following information for three days, group A, number of people in each family of 12 families; group B, number of learners in each class in our school; group C number of girls and group D number of boys in the classes here at school so that they know what is it that becomes data when they find it in their textbooks. I also encourage my learners to go and ask other people especially teachers here at school even after I have taught them the terminology or to read around and from the textbook for them to understand better other than just from me as their teacher and if they get something different	**CQ2.** What resources does the teacher use to explain mathematical terminology? Intertextuality also in red

	they should come back and tell us in class what they have found different. I want them to be resourceful also.	Highlighted: Definition Discourse
IQ5	What do you consider as a proper definition of the mathematical term you teach? Why?	
PR5	Not to confuse my learners and also myself I stick to the mathematical definitions of the textbook only and because we teach towards examinations it is better to teach what is commonly accepted and we know what is commonly accepted is in the textbook…I want my learners not to get surprised when they hear the same word being used in different contexts they should know the mathematical meaning and be able to use it properly in mathematics.	**CQ3.** What discourse practices are involved in the explanation process Highlighted: Definition Discourse
IQ6	Why were you using the language of instruction (language of mathematics) throughout your teaching?	
PR6	We do have learners who speak different languages, in addition, I even have foreign children from Zambia and Lesotho in that class, a lot are Zulus and I am a Xhosa, so I…find it unfair to use my language which will make a few to benefit and again I find myself confident in using English, it's easy for me because I did mathematics in English at school also. Besides I want the learners to be confident and to get the definitions straight in the accepted language of mathematics so that they do not get confused when they come across the words in other subjects…they should be able to differentiate a mathematical meaning from other subjects'	**CQ2a.** Which languages does the teacher use Discourse of the smaller case "d"

	meanings of the same word.	
IQ7	What classroom communications do you see effective in making the learners understand mathematical terms?	
PR7	I find group work and report back working well for me, as you just saw in most lessons, because even if I would have explained the definition… learners need to discuss on their own and with this they share their understandings and they do that using their languages…and it helps those who would have missed during my teaching. Another communication they get the terms better is when I use examples, models or go out of class like what they did to go and collect their own data for them to understand what data is. And terms whose meanings can be demonstrated…if there is a demonstration to accompany the word most of them understand it very well though I cannot give an example of such word now. But normally I write the term on the board and ask questions, and when they give some responses I might use the responses to ask more questions as a follow-up…or I ask them to read from the book and explain to the class their understanding of the terms…then I finalise by explaining the term according to the textbook we are using in class.	**CQ3.** What discourse practices are involved in the explanation process Highlighted: Definition Discourse

Appendix C: Lessons 1, 2 and 4 Coded Transcripts

Lesson One: Coded Transcript

Speaker	**Utterance**	**Code**	**Comment**
L1:1 Teacher	[When the teacher and I entered the classroom, most learners were making noise, and those who were not sited ran to take their places, some learner went and rubbed the board…	**CB**	The big 'D' discourse – clean chalkboard, it suggest a norm and a practice (Gee, 2005) of the class to use a clean chalkboard. Because a learner was seen rubbing the board before teaching took place without being asked to do so.
	…and came back to join the others. The teacher walked around and learners were seen putting away some non-mathematical items e.g. books…	**CC**	Class control is an indication of 'D'; it suggests that the teacher draws learners' attention on what she is to teach … 'putting away some non-mathematical items' suggests a culture the teacher has cultivated in the classroom (Gee, 2005). The teacher walked around the class and learners put away some items.
	…and sat quietly in groups facing the board waiting for the teacher's opening instruction of the lesson.	**GSB** **CIT1**	'D' – sitting in groups facing the board, suggests teacher's classroom sitting arrangement and the interactive pattern, CIT1, (Scott et al., 2006), she approves of when teaching mathematical terms. Learners were observed seated in groups facing to the front.
	The teacher went in front far right and spoke].	**FC**	'D' - standing in front of the class, suggests teacher's teaching position when introducing terminology to the learners because the teacher went to the front of the class before talking to learners.
	I gave you some data to go and study,	**HW**	This is indicative of 'D' practice in the classroom. It suggests that learners are

		RK	given homework in preparation of the next lesson; the teacher indicated that she had given learners some data to go and work on in groups prior to current lesson.
	…and you were working in groups so each group should tell us what they did, ok.	**GWS** **CIT1**	'D' – group work, it suggests teacher's teaching strategy which creates and engages learners in sound CIT1 pattern of interaction when teaching mathematical terms (Scott et al., 2006). This is so because the teacher gave learners work to do in groups and now each group is to report back.
	What did you find from the work I gave you?	**QR**	This is indicative of 'D' practice in the classroom. It suggests that learners are involved in the definition of terms because the teacher asks a question intending to get a response from learners and a learner responded.
		QAS	'D' – which suggests IRE (initiation response evaluation type of presentation) (Scott et al., 2006), and a question and answer teaching strategy in the definition of terms. The teacher is asking learners what they got from the data and the answer is 'range', this is the term she was intending to teach because she allowed a long exchange on its explanation. It also suggests practice work is given to learners
L1:2 Learner	The range	**VT**	'D' - which suggests terms are sometimes verbalised
L1:3 Teacher	Ooh he is saying the range,	**RV**	'D' - which suggests teacher re-voices learners' answers (Enyedy et al., 2008) in the process of defining terms, the teacher tells the class that the learner was saying range i.e. re-voicing, and that teacher re-voices for the whole class to hear what the learner had said. It could be that the learner was also speaking softly.

	what he has found out is that there is a range there. So range is there,	**ML**	‘d’ in ‘D’ –English, a communication tool (Gee, 2005), this suggests that the teacher is using the mathematical language as a communication tool in the explanation of terms. The teacher is communicating in English to the learners. The teacher is reaffirming the learners’ answer or evaluating it.
	is the range part of the five number summary, yes, no	**QR**	This is indicative of ‘D’ practice in the classroom. It suggests that learners are involved in the definition of terms because the teacher asks a question intending to get a response from learners. The teacher is coercing a ‘chorus answer’
		VT	‘D’ - which suggests terms are sometimes verbalised
		RFQ	A ‘D’ in that the teacher uses learners’ responses to ask further questions and it suggests teacher’s level of response the IR2/3, prodding learners towards a predetermined definition of the term. The teacher used range (learner’s answer) to ask if it is part of number summary.
L1:4 Class	No	**UR**	‘D’ – unison response, it suggests that this way of answering (Gee, 2005) is allowed by the teacher. The class is answering in unison and the teacher does not condemn the behaviour.
L1:5 Teacher	Okay let's just write it even though,	**WLI**	‘D’ – writing leaner idea on the board, it suggests teacher’s interactive/authoritative approach (Scott et al., 2006), to teaching terminology she is the one who decides to write or not to write by saying “let’s just write it”
	because that's what he has learned about [writes the term ‘range’ on the board],	**WTB**	‘D’ - chalkboard use, a classroom practice, which indicates that that the teacher writes the term on the board for learners to see and draw their attention to the term. A practice which suggests teacher’s interactive/authoritative presentation of terms in class (Scott et al., 2006). The teacher was observed writing the term on

			the board.
	saying the range, how do you define the range, what is the range	**QR** **ML**	This is indicative of 'D' practice in the classroom. It suggests that learners are involved in the definition of terms because the teacher asks the question "how do you define the range" intending to get a response from learners.
		DQ	'D' - descriptive question, it suggests that the teacher uses descriptive questions in facilitating learners' access to terminology in the explanation of terms. For example, the question 'why three and not…' needs Nicho to justify his answer "We only look to three…" in the justification he describes what three stands for in the quartiles. It is also a high order question
		QAS	'D' – which suggests IRE (initiation response evaluation type of presentation) (Scott et al., 2006), and a question and answer teaching strategy in the definition of terms. This is one of the strategies the teacher is using – getting the definition from the learners.
L1:6 Class	Highest score minus lowest score	**UR** **ML**	'D' – unison response, it suggests that this way of answering (Gee, 2005) is allowed by the teacher because the teacher does not criticise the behaviour.
		PE	It is an indication of 'D' practice and it suggests that the teacher accepts procedural way of defining the term. This is shown by the whole class defining the term 'range' in a procedural way.
L1:7 Teacher	Ok, I will separate whatever you give me, tell me whether it falls under the five number summary,	**CI**	Is a 'D' practice which suggests that the teacher considers learners' ideas and contributions in the definition of terms because the teacher suggests to separate learners' ideas than ignoring them.

	right, what else, Joy	**CL**	‘D’ - call out learner’s name, suggests a practice the teacher performs when a response from a learner is needed, she called on Joy to give her idea. It could be way of ensuring discipline and getting learners to pay attention.
L1:8 Joy	No idea		
L1:9 Nicho	We only look to three first quartile	**BB**	‘D’ – learner interjection without being called upon is a practice in the classroom. It shows that blurting out behaviour is allowed because Nicho interjected while the teacher was still talking to Joy and did not condemn it instead the teacher-learner exchanges were now between the teacher and Nicho.
		VT	‘D’ - which suggests terms are sometimes verbalised
L1:10 Teacher	Three, why three and not...	**IJ**	Justifying, a ‘D’ practice which identifies the talk in the classroom with that of mathematicians (Gee, 2005). It suggests that learners are expected to justify their ideas because the teacher asked Nicho “why three” ”. Also some form of mathematical reasoning being enforced or encouraged.
		DQ	‘D’ - descriptive question, it suggests that the teacher uses descriptive questions in facilitating learners’ access to terminology in the explanation of terms. For example, the question ‘why three and not…’ needs Nicho to justify his answer “We only look to three…” in the justification he describes what three stands for in the quartiles. It is also a high order question
	[with a surprised face]	**E**	A facial expression, Grammar 2, was used to accompany verbal communication (Gee, 2005), therefore, it is a ‘D’ practice. It suggests that the teacher approves of non-verbal communication in the explanation of the terms.

L1:11 Nicho	Quartile, it's the lower quartile which is the median of the first half	**DR** **TDD** **IR3 ML**	A descriptive response, a textbook descriptive definition of the term which is of level IR3 is part of the 'D', this is what Nicho gave and the teacher acknowledges it by reminding learners of it being the lower quartile of the data.
		VT	'D' - which suggests terms are sometimes verbalised
L1:12 Teacher	Lower...	**INCS**	Leaving incomplete sentences is a way of talking the teacher allows (Gee, 2005); therefore, it is a 'D' practice she approves of because she allows learners to complete her incomplete sentence "Lower...."
L1:13 Class	Quartile	**UR**	'D' – unison response, it suggests that this way of answering (Gee, 2005) is allowed by the teacher learners answered chorally and were not condemned.
L1:14 Teacher	What's the abbreviation of the lower quartile	**QR ML**	This is indicative of 'D' practice in the classroom. It suggests that learners are involved in the definition of terms because the teacher asks a question intending to get a response from learners. Also suggests teaching of conventional abbreviations
		QAS	'D' – which suggests IRE (initiation response evaluation type of presentation) (Scott et al., 2006), and a question and answer teaching strategy in the definition of terms.
L1:15 Class	Q1	**UR**	'D' – unison response, it suggests that this way of answering (Gee, 2005) is allowed by the teacher
L1:16 Teacher	Q1 [writes Q1 on the board]	**WLI**	'D' – writing leaner idea on the board, suggest teacher's interactive/authoritative approach (Scott et al., 2006), to teaching terminology

		WTB	'D' writing terms on the board
	Okay	**AC**	'D' – This suggests that the teacher acknowledges and values learners' ideas.
	and the other one?	**QR**	This is indicative of 'D' practice in the classroom. It suggests that learners are involved in the definition of terms because the teacher asks a question intending to get a response from learners. This a prompt is to ensure that all expected answers are provided
L1:17 Class	The median	**UR ML**	'D' – unison response, it suggests that this way of answering (Gee, 2005) is allowed by the teacher
L1:18 Teacher	The median,	**RV ML**	'D' - which suggests teacher re-voices learners' answers (Enyedy et al., 2008) in the process of defining terms, the teacher re-uttered "the median" after the class had said it.
	right median	**AC**	'D' – This suggests that the teacher acknowledges and values learners' ideas by saying "right median" and asked for its abbreviation. Teacher is evaluating learners' response.
	the abbreviation	**RFQ**	A 'D' in that the teacher uses learners' responses to ask further questions and it suggests teacher's level of response the IR2/3, prodding learners towards a predetermined definition of the term. The teacher used the answer "median" to ask for its abbreviation. The abbreviation is part of the topic's discourse.
L1:19 Class	Q2 or M	**UR**	'D' – unison response, it suggests that this way of answering (Gee, 2005) is allowed by the teacher
L1:20	Q2 or M, This one [pointing at M on the	**RCW**	Referring to chalkboard work is indicative of a 'D' practice. It suggests that the

Teacher	board]	**ML**	teacher values chalkboard work as she was seen pointing to the work at the board in her explanation of the terms.
L1:21 Class	Yes	**UR**	‘D’ – unison response, it suggests that this way of answering (Gee, 2005) is allowed by the teacher
L1:22 Teacher	Which is the median, what is the median,	**QR** **VT ML**	This is indicative of ‘D’ practice in the classroom. It suggests that learners are involved in the definition of terms because the teacher asks a question intending to get a response from learners. Getting learners to define term as she verbalise the term.
		QAS	‘D’ – which suggests IRE (initiation response evaluation type of presentation) (Scott et al., 2006), and a question and answer teaching strategy in the definition of terms.
	who can define for us,	**DQ**	‘D’ - descriptive question, it suggests that the teacher uses descriptive questions in facilitating learners’ access to terminology in the explanation of terms. For example, the question “who can define…” means that the teacher is looking for a descriptive explanation of the term ‘median’ and the explanation of it will conceptually enhance learners’ understanding.
	[looking for a volunteer and pointing to a learner] let’s go back a little bit	**G**	‘D’ – Grammar 2 (Gee, 2005), in that the teacher uses gestures to accompany verbal communication. It suggests that the teacher practices a non-verbal communication in the explanation of the terms, here the teacher was observed looking around and pointing to a learner who then gave descriptive explanation of the term. She points at learners at random (in no particular order).

L1:23 Learner	The number that divides that divides the data into two parts, right [asking if he was right]	**DR** **TDD** **IR3 ML**	A descriptive response, a textbook descriptive definition of the term which is of level IR3 is part of the 'D'; it suggests that the teacher accepts descriptive explanation of the term because gave it and she acknowledges it "Right". Learners, as a practice, confirm with the teacher if their responses are correct.
L1:24 Teacher	Right,	**AC**	'D' – This suggests that the teacher accepts descriptive explanation of the term by acknowledging it "Right", it also shows that she values learners' ideas. Evaluates learners answer.
	it is the middle value of that data when the data is arranged in order of size, right,	**DE** **TDD IR3 ML**	A descriptive explanation, a textbook descriptive definition of the term which is of level IR3 is part of the 'D'. It suggests that the teacher accepts descriptive definition in the explanation of terms; this is indicated by the teacher's remoulding of learner's answer giving a textbook descriptive definition. The teacher re-voices the definition (probably with a textbook definition)
		STB	This is indicative of 'D', i.e. source of definition. It suggests that the teacher uses a textbook as a source of definitions. This is so because the descriptive explanation she gave here, from my experience as a mathematics teacher, is a textbook one.
		RMD AE	'D'– remoulding, it suggests that the teacher remoulds and adds to learner's explanations as she leads learners towards predetermined definitions. This is so because the teacher remoulds leaner's response using the textbook definition.
	[paraphrasing learner's utterance]	**PP**	Paraphrasing learner's answer (Pressley et al, 1989) is an indication of a 'D' practice, here the teacher paraphrases learner's textbook descriptive definition of the term 'median' towards a predetermined definition.

	Next what is the third quartile	**QR**	This is indicative of 'D' practice in the classroom. It suggests that learners are involved in the definition of terms because the teacher's question intends learners to response.
		VT	'D' - which suggests terms are sometimes verbalised
		QAS	'D' – which suggests IRE (initiation response evaluation type of presentation) (Scott et al., 2006), and a question and answer teaching strategy in the definition of terms.
L1:25 Class	Upper quartile	**UR ML**	'D' – unison response, it suggests that this way of answering (Gee, 2005) is allowed by the teacher
L1:26 Teacher	Upper quartile	**RV ML**	'D' - which suggests teacher re-voices learners' answers (Enyedy et al., 2008) in the process of defining terms
	[writing on the board]	**WLI**	'D' – writing leaner idea on the board, suggest teacher's interactive/authoritative approach (Scott et al., 2006), to teaching terminology because the teacher wrote learners' answer on the board.
		WTB	'D' writing terms on the board
	how do we abbreviate	**QR**	This is indicative of 'D' practice in the classroom. It suggests that learners are involved in the definition of terms because the teacher asks a question intending to get a response from learners. Thus teaching of abbreviations.
		QAS	'D' – which suggests IRE (initiation response evaluation type of presentation) (Scott et al., 2006), and a question and answer teaching strategy in the definition

			of terms.
L1:27 Class	Q3	**UR**	'D' – unison response, it suggests that this way of answering (Gee, 2005) is allowed by the teacher
L1:28 Teacher	Q3,	**RV**	'D' - which suggests teacher re-voices learners' answers (Enyedy et al., 2008) in the process of defining terms
	okay	**AC**	'D' – This suggests that the teacher acknowledges and values learners' ideas.
	how many do we have now	**QR**	This is indicative of 'D' practice in the classroom. It suggests that learners are involved in the definition of terms because the teacher asks a question intending to get a response from learners. Inviting learners to count the number of terms used so far.
	[pointing to the work on the board]	**G**	'D' – Grammar 2 (Gee, 2005), in that the teacher uses gestures to accompany verbal communication. It suggests that the teacher approves of non-verbal communication in the explanation of the terms.
L1:29 Class	Three	**UR**	'D' – unison response, it suggests that this way of answering (Gee, 2005) is allowed by the teacher
L1:30 Teacher	One, two, three,	**RV**	'D' - which suggests teacher re-voices learners' answers (Enyedy et al., 2008) in the process of defining terms The teacher is asking for a definite answer and at the same time encouraging a chorus answer.
	[pointing to Q1, M, and Q2]	**G**	'D' – Grammar 2 (Gee, 2005), in that the teacher uses gestures to accompany verbal communication. It suggests that the teacher approves of non-verbal

			communication in the explanation of the terms. Assisting learners to provide a correct answer.
	but what are we looking for	**QR** **PLQ**	This is indicative of 'D' practice in the classroom. It suggests that learners are involved in the definition of terms because the teacher asks a question intending to get a response from learners. The teacher is probing
	[facial expressions and	**E**	A facial expression, Grammar 2, was used to accompany verbal communication (Gee, 2005), therefore, it is a 'D' practice. It suggests that the teacher approves of non-verbal communication in the explanation of the terms.
	hands movements indicating that all what was explained was heading to an important key term or phrase]	**G**	'D' – Grammar 2 (Gee, 2005), in that the teacher uses gestures to accompany verbal communication. It suggests that the teacher approves of non-verbal communication in the explanation of the terms.
L1:31 Class	Five number summary	**UR ML**	'D' – unison response, it suggests that this way of answering (Gee, 2005) is allowed by the teacher
		VT	'D' - which suggests terms are sometimes verbalised
L1:32 Teacher	Two outstanding values are...	**INCS**	Leaving incomplete sentences is a way of talking the teacher allows (Gee, 2005); therefore, it is a 'D' practice she approves of because she allows learners to complete her incomplete sentence.
L1:33 Class	Minimum value and maximum value	**UR ML**	'D' – unison response, it suggests that this way of answering (Gee, 2005) is allowed by the teacher
L1:34	It is the minimum value and maximum	**RV ML**	'D' - which suggests teacher re-voices learners' answers (Enyedy et al., 2008) in

Teacher	value,		the process of defining terms
		VT	'D' - which suggests terms are sometimes verbalised
	right,	**AC**	'D' – This suggests that the teacher acknowledges and values learners' ideas.
	I want us to look at exercise eight point six on page one hundred eighty nine,	**TB**	This is indicative of 'D', i.e. textbook use. It suggests that the teacher uses a textbook in the explanation of the terms for she is asking learners to look at exercise eight point six on page one hundred eighty nine.
	there it says... in your groups,	**GWS** **CIT1**	'D' – group work, it suggests teacher's teaching strategy which creates and engages learners in sound CIT1 pattern of interaction when teaching mathematical terms (Scott et al., 2006). The teacher is authoritatively asking learners to do exercise eight point six in groups.
	the baker keeps (...) of number of dough nuts sold a day for three weeks, the numbers are (...) there is data that is listed there,	**TB** **ML**	This is indicative of 'D', i.e. textbook use. It suggests that the teacher uses a textbook in the explanation of the terms because she is reading from the textbook.
	they said find the range using the formula that the range is equal to highest score minus...	**F**	Using formula is indicative of 'D', i.e. some practice in the classroom. It suggests that the teacher facilitates learners' access to terminology through the procedural way. The teacher asks learners to find the range using the formula.
		TPD	This is indicative of 'D', i.e. textbook procedures. It suggests that the teacher uses the textbook procedures in getting the meaning of terms in the explanation of the terms. This sound so because the teacher is giving a procedural way of getting then range by saying "range is equal to highest score minus..."

		INCS	Leaving incomplete sentences is a way of talking the teacher allows (Gee, 2005); therefore, it is a 'D' practice she approves of because she allows learners to complete her incomplete sentence.
		PE **IR2**	A procedural explanation, in defining the term and is of level IR2, is part of the 'D', range was defined through using the formula as 'highest score minus... lowest score' it shows that this way of defining terms is accepted.
L1:35 Class	Lowest score	**UR**	'D' – unison response, it suggests that this way of answering (Gee, 2005) is allowed by the teacher
L1:36 Teacher	Right,	**AC**	'D' – This suggests that the teacher acknowledges and values learners' ideas.
	I want you in your groups (...) on the data;	**GWS** **CIT1**	'D' – group work, it suggests teacher's teaching strategy which creates and engages learners in sound CIT1 pattern of interaction when teaching mathematical terms (Scott et al., 2006)
	find the range and	**IL** **ML**	An indication of an interactive/authoritative presentation of the teacher (Scott et al., 2006), i.e. a 'D' practice in the classroom. It suggests that learners are instructed to do some work.
		PQ	'D'– which suggests IRE (initiation response evaluation type of presentation) (Scott et al., 2006), and a question and answer teaching strategy in the definition of terms. The question is requiring learners to calculate and find the range of the data, therefore, understanding the term from its calculational premises.
	the five number…	**INCS**	Leaving incomplete sentences is a way of talking the teacher allows (Gee, 2005); therefore, it is a 'D' practice she approves of because she allows learners to

			complete her incomplete sentence.
L1:37 Class	Summary	**UR**	'D' – unison response, it suggests that this way of answering (Gee, 2005) is allowed by the teacher
L1:38 Teacher	Five number summary	**RV**	'D' - which suggests teacher re-voices learners' answers (Enyedy et al., 2008) in the process of defining terms
	in your groups,	**GWS CIT1**	'D' – group work, it suggests teacher's teaching strategy which creates and engages learners in sound CIT1 pattern of interaction when teaching mathematical terms (Scott et al., 2006)
	I will be moving in your groups checking ,	**CLW**	An indicative of 'D' practice in the classroom. It suggests that the teacher checks learners' work.
	okay, what is the first step, what do you do [moving around the class helping the groups]	**QR**	This is indicative of 'D' practice in the classroom. It suggests that learners are involved in the definition of terms because the teacher asks a question intending to get a response from learners.
		PQ	'D' – which suggests IRE (initiation response evaluation type of presentation) (Scott et al., 2006), and a question and answer teaching strategy in the definition of terms. The question is requiring learners to identify the steps followed in finding the 'range' of the data, therefore, understanding the term from its calculational premises.
L1:39 Many learners	Arranging in...	**UR**	'D' – unison response, it suggests that this way of answering (Gee, 2005) is allowed by the teacher

in one group			
L1:40 Teacher	Arranging in...	**INCS**	Leaving incomplete sentences is a way of talking the teacher allows (Gee, 2005); therefore, it is a 'D' practice she approves of because she allows learners to complete her incomplete sentence.
L1:41 Many learners	In ascending order	**UR ML**	'D' – unison response, it suggests that this way of answering (Gee, 2005) is allowed by the teacher
L1:42 Teacher	Arrange the data in ascending order, quickly do that,	**RMD AE ML**	'D' – remoulding, it suggests that the teacher remoulds and adds to learner's explanations as she leads learners towards predetermined definitions. This is so because the teacher remoulds leaner's response using the textbook definition.
		IL	An indication of an interactive/authoritative presentation of the teacher (Scott et al., 2006), i.e. a 'D' practice in the classroom. It suggests that learners are instructed to do some work.
	why are you five in one group [insisting on four in a group]	**GSB** **CIT1**	'D' – sitting in groups facing the board, suggests teacher's classroom sitting arrangement and the interactive pattern, CIT1, (Scott et al., 2006), she approves of when teaching mathematical terms.
L1:43 Teacher	Who (...) okay what is the range, can you define range, if not yet understood	**QR ML**	This is indicative of 'D' practice in the classroom. It suggests that learners are involved in the definition of terms because the teacher asks a question intending to get a response from learners. Seeking definition from learners.

		QAS	‘D’ – which suggests IRE (initiation response evaluation type of presentation) (Scott et al., 2006), and a question and answer teaching strategy in the definition of terms.
		DQ	‘D’ - descriptive question, it suggests that the teacher uses descriptive questions in facilitating learners’ access to terminology in the explanation of terms by providing a conceptual understanding. The question “what is the range, can you define range” solicits a conceptual explanation of the term ‘range’ and it aims at deepening learners’ understanding of the term conceptually.
	[opening the hands with a sharp facial expression in surprise]	**G**	‘D’ – Grammar 2 (Gee, 2005), in that the teacher uses gestures to accompany verbal communication. It suggests that the teacher approves of non-verbal communication in the explanation of the terms.
		E	A facial expression, Grammar 2, was used to accompany verbal communication (Gee, 2005), therefore, it is a ‘D’ practice. It suggests that the teacher approves of non-verbal communication in the explanation of the terms.
L1:44 Class	Yes [nodding their heads in agreement of not getting the definition right]	**UR**	‘D’ – unison response, it suggests that this way of answering (Gee, 2005) is allowed by the teacher
L1:45 Teacher	Quickly calculate it	**TPD**	This is indicative of ‘D’, i.e. textbook procedures. It suggests that the teacher uses the textbook procedures in getting the meaning of terms (Ball, 1990), it also suggests that the teacher is practicing a Calculational Discourse (Setati, 2005b) in the explanation of the terms.
		PQ	‘D’ – which suggests IRE (initiation response evaluation type of presentation) (Scott et al., 2006), and a question and answer teaching strategy in the definition

			of terms. The question is requiring learners to calculate and find the range of the data, therefore, understanding the term from its calculational premises.
		IL **ML**	An indication of an interactive/authoritative presentation of the teacher (Scott et al., 2006), i.e. a 'D' practice in the classroom. It suggests that learners are instructed to do some work.
L1:46 Learner	Fifty two... the range	**BB**	'D' – learner interjection without being called upon is a practice in the classroom. It shows that blurting out behaviour is allowed because the learner shouted out the answer without being called upon.
		PR	It is an indication of 'D' practice and it suggests a 'valued' procedural response from a learner and the teacher accepts the meaning of the term in value form which is obtained from a procedural way of finding range.
L1:47 Teacher	What is the range here, what is the range,	**QAS** **ML**	'D' – which suggests IRE (initiation response evaluation type of presentation) (Scott et al., 2006), and a question and answer teaching strategy in the definition of terms.
		PQ	'D' - procedural question, it suggests that the teacher uses procedural questions in facilitating learners' access to terminology in the explanation of terms. The question requires learners to find 'range' in value form.
	do you get range here,	**QR**	This is indicative of 'D' practice in the classroom. It suggests that learners are involved in the definition of terms because the teacher asks a question intending to get a response from learners.

	where is your book [checking learner's work]	**CLW**	An indicative of 'D' practice in the classroom. It suggests that the teacher checks learners' work.
L1:48 Learner	It's forty five	**PR**	It is an indication of 'D' practice and it suggests a 'valued' procedural response from a learner and the teacher accepts the meaning of the term in value form which is obtained from a procedural way of finding range.
L1:49 Teacher	Right,	**AC**	'D' – This suggests that the teacher acknowledges and values learners' ideas.
	what is your range here,	**QR** **ML**	This is indicative of 'D' practice in the classroom. It suggests that learners are involved in the definition of terms because the teacher asks a question intending to get a response from learners.
		PQ	'D' - procedural question, it suggests that the teacher uses procedural questions in facilitating learners' access to terminology in the explanation of terms. The question requires learners to find 'range' in value form
		QAS	'D' – which suggests IRE (initiation response evaluation type of presentation) (Scott et al., 2006), and a question and answer teaching strategy in the definition of terms.
	right people can we just summarise here,	**SD**	Summing-up classroom deliberations are an indication of 'D', it suggests that the teacher is the leader and knows when to close up discussions. It also suggests that predetermined definitions are given by the teacher.

	what is the range	**QR**	This is indicative of 'D' practice in the classroom. It suggests that learners are involved in the definition of terms because the teacher asks a question intending to get a response from learners.
		PQ	'D' - procedural question, it suggests that the teacher uses procedural questions in facilitating learners' access to terminology in the explanation of terms. Such question asks for a calculated value 'range'
		QAS	'D' – which suggests IRE (initiation response evaluation type of presentation) (Scott et al., 2006), and a question and answer teaching strategy in the definition of terms.
	[going back to the board]	**RCW**	Referring to chalkboard work is an indicative of a 'D' practice. It suggests that the teacher values chalkboard work as she was seen pointing to the work at the board in her explanation of the terms.
L1:50 Class	Forty eight	**UR**	'D' – unison response, it suggests that this way of answering (Gee, 2005) is allowed by the teacher
		PR	It is an indication of 'D' practice and it suggests a 'valued' procedural response from a learner and the teacher accepts the meaning of the term in value form which is obtained from a procedural way of finding range.
L1:51 Teacher	Forty eight,	**RV**	'D' - which suggests teacher re-voices learners' answers (Enyedy et al., 2008) in the process of defining terms
	people did we arrange from the highest to the lowest, yes or no	**HC ML**	Giving hints or clues is a 'D' practice which suggests that the teacher uses hints and clues to aid learners in the explanation of terms.

		PLQ	An indicative of a 'D' practice, prodding learners using questions which lead to a predetermined definition in level IR2/3, the teacher probes to learners to arrange from the highest to the lowest score of the data.
		PQ	'D' - procedural question, it suggests that the teacher uses procedural questions in facilitating learners' access to terminology in the explanation of terms. Such question leads to calculational understanding of the term 'range'.
		CIT2	A form of interaction in the 'D' which suggests that the teacher interacts with the whole class other than groups i.e. whole-class interaction (Scott et al., 2006)
L1:52 Class	No	**UR**	'D' – unison response, it suggests that this way of answering (Gee, 2005) is allowed by the teacher
L1:53 Teacher	No,	**RV**	'D' - which suggests teacher re-voices learners' answers (Enyedy et al., 2008) in the process of defining terms
	because you will be wasting your time, look (...) find the highest score, find the lowest score and (...) move on, now number 2,	**HC** **ML**	Giving hints or clues is a 'D' practice which suggests that the teacher uses hints and clues to aid learners in the explanation of terms by asking them to find the highest and the lowest scores form the data.
		PQ	'D' - procedural question, it suggests that the teacher uses procedural questions in facilitating learners' access to terminology in the explanation of terms. The question requires learners to give a calculated value 'range'
	we have the range there, what is the highest score there	**QR**	This is indicative of 'D' practice in the classroom. It suggests that learners are involved in the definition of terms because the teacher asks a question intending to get a response from learners.

		QAS	'D' – which suggests IRE (initiation response evaluation type of presentation) (Scott et al., 2006), and a question and answer teaching strategy in the definition of terms.
		PLQ	An indicative of a 'D' practice, prodding learners using questions which lead to a predetermined definition in level IR2/3, the teacher probes to learners to give the highest score of the data.
L1:54 Class	Eighty two	**UR**	'D' – unison response, it suggests that this way of answering (Gee, 2005) is allowed by the teacher
		PR	It is an indication of 'D' practice and it suggests a 'valued' procedural response from a learner and the teacher accepts the meaning of the term in value form which is obtained from a procedural way of finding range.
L1:55 Teacher	Eighty two minus the lowest...	**INCS** **ML**	Leaving incomplete sentences is a way of talking the teacher allows (Gee, 2005); therefore, it is a 'D' practice she approves of because she allows learners to complete her incomplete sentence.
		TPD	This is indicative of 'D', i.e. textbook procedures. It suggests that the teacher uses the textbook procedures in getting the meaning of terms in the explanation of the terms.
L1:56 Class	Thirty four	**UR**	'D' – unison response, it suggests that this way of answering (Gee, 2005) is allowed by the teacher
		PR	It is an indication of 'D' practice and it suggests a 'valued' procedural response from a learner and the teacher accepts the meaning of the term in value form

			which is obtained from a procedural way of finding range.
L1:57 Teacher	Which is [pointing at the data set on the board]	**G**	'D' – Grammar 2 (Gee, 2005), in that the teacher uses gestures to accompany verbal communication. It suggests that the teacher approves of non-verbal communication in the explanation of the terms.
L1:58 Class	Forty eight	**UR**	'D' – unison response, it suggests that this way of answering (Gee, 2005) is allowed by the teacher
		PR	It is an indication of 'D' practice and it suggests a 'valued' procedural response from a learner and the teacher accepts the meaning of the term in value form which is obtained from a procedural way of finding range.
L1:59 Teacher	Forty eight,	**RV**	'D' - which suggests teacher re-voices learners' answers (Enyedy et al., 2008) in the process of defining terms
	right who is done with number 2a,	**AC**	'D' – This suggests that the teacher acknowledges and values learners' ideas.
	okay there is a hand [going to one of the groups],	**GWS** **CIT1**	'D' – group work, it suggests teacher's teaching strategy which creates and engages learners in sound CIT1 pattern of interaction when teaching mathematical terms (Scott et al., 2006)

	label lower quartile, so that you remember, eh next aah what's this, you must write quartile, median, range or... what? please don't just write anything you don't know, use both please, sometimes you find out that both of them (...) so don't summarise too much, next	**BWRT ML**	A 'D' practice in the classroom. It suggests that learners write the definition of terms and follow a certain way of presenting work in their books which is accepted in the mathematics classroom (Gee, 2005).
L1:60 Learner	Ihi forty six {its forty six}		
L1:61 Teacher	They say arrange after that number b [looking into the textbook]	**TB**	This is indicative of 'D', i.e. textbook use. It suggests that the teacher uses a textbook in the explanation of the terms.
L1:62 Learner	*Sithole imedian, le ephakhati khuphela forty six* {We have found the median, the only one in the middle is forty six}	**NML**	'd' (Gee, 2005) in 'D' – non-mathematical language, this suggests that learners are allowed to communicate in their own languages at times
L1:63 Teacher	The median number is the middle number which one is the middle number	**QR**	This is indicative of 'D' practice in the classroom. It suggests that learners are involved in the definition of terms because the teacher asks a question intending to get a response from learners.
		QAS	'D' – which suggests IRE (initiation response evaluation type of presentation) (Scott et al., 2006), and a question and answer teaching strategy in the definition of terms.

		ML	‘d’ in ‘D’ –English, a communication tool (Gee, 2005), this suggests that the teacher is using the mathematical language as a communication tool in the explanation of terms.
L1:64 Learner	Between sixty seven and sixty two	**PE**	It is an indication of ‘D’ practice and it suggests that the teacher accepts the meaning of the term in value form which is obtained from a procedural way of finding median.
L1:65 Teacher	Between sixty seven and sixty two (-) you say the median is between sixty seven and sixty two	**RV ML**	‘D’ - which suggests teacher re-voices learners’ answers (Enyedy et al., 2008) in the process of defining terms
L1:66 Learner	Yes		
L1:67 Teacher	Which one is in the middle, okay let’s check	**QR ML**	This is indicative of ‘D’ practice in the classroom. It suggests that learners are involved in the definition of terms because the teacher asks a question intending to get a response from learners.
		PQ	‘D’ - procedural question, it suggests that the teacher uses procedural questions in facilitating learners’ access to terminology in the explanation of terms. Such question leads to calculational understanding of the term ‘median’.
	did you arrange in ascending order, so which one is your median then, okay lets count, count the data, count your scores there,	**HC**	Giving hints or clues is a ‘D’ practice which suggests that the teacher uses hints and clues to aid learners in the procedural explanation of terms.

	how many scores do you have one two three four five [counting the scores together with the learner] seven so which one is in the middle	**LQ**	This is indicative of 'D', i.e. some practice in the classroom. It suggests that learners are asked leading questions which can help them define terms.
L1:68 Learner	Fifty	**PR**	It is an indication of 'D' practice and it suggests a 'valued' procedural response from a learner and the teacher accepts the meaning of the term in value form which is obtained from a procedural way of finding median.
L1:69 Teacher	Its true fifty? [in disbelief] can you put your hand on top of fifty, count this side then that side,	**IL**	An indication of an interactive/authoritative presentation of the teacher (Scott et al., 2006), i.e. a 'D' practice in the classroom. It suggests that learners are instructed to do some work.
		HC	Giving hints or clues is a 'D' practice which suggests that the teacher uses hints and clues to aid learners in the procedural explanation of the term.
	so let's just count seventy eight sixty seven which one is the middle number, you know what, your scores are not the same	**LQ ML**	This is indicative of 'D', i.e. some practice in the classroom. It suggests that learners are asked leading questions which can help them define terms.
	are you working as a whole group	**GWS CIT1**	'D' – group work, it suggests teacher's teaching strategy which creates and engages learners in sound CIT1 pattern of interaction when teaching mathematical terms (Scott et al., 2006)
L1:70 Learner	Yes		

L1:71 Teacher	No [shaking the head], she got seventy six, she has sixty nine we don't have sixty nine,	**G**	'D' – Grammar 2 (Gee, 2005), in that the teacher uses gestures to accompany verbal communication. It suggests that the teacher approves of non-verbal communication in the explanation of the terms.
	you are not working in a group, you must discuss as a group, you see,	**GWS** **CIT1** **GD**	'D' – group work, it suggests teacher's teaching strategy which creates and engages learners in sound CIT1 pattern of interaction when teaching mathematical terms (Scott et al., 2006)
	let me see, seventy eight, sixty nine and which did you add extra it seems you have other one extra,	**CLW**	An indicative of 'D' practice in the classroom. It suggests that the teacher checks learners' work.
	so you see that's why the median is not the same, so how did you define the median,	**QR ML**	This is indicative of 'D' practice in the classroom. It suggests that learners are involved in the definition of terms because the teacher asks a question intending to get a response from learners.
		QAS	'D' – which suggests IRE (initiation response evaluation type of presentation) (Scott et al., 2006), and a question and answer teaching strategy in the definition of terms.
		DQ	'D' - descriptive question, it suggests that the teacher uses descriptive questions in facilitating learners' access to terminology in the explanation of terms. The question is seeking learners' conceptual understanding of the term 'median'
	you say the median is the middle number,	**R**	A 'D' practice in the classroom which suggests that the teacher at times revisits ideas.

	what does middle mean	**QR**	This is indicative of ‘D’ practice in the classroom. It suggests that learners are involved in the definition of terms because the teacher asks a question intending to get a response from learners.
		QAS	‘D’ – which suggests IRE (initiation response evaluation type of presentation) (Scott et al., 2006), and a question and answer teaching strategy in the definition of terms.
		DQ **PLQ**	‘D’ - descriptive question, it suggests that the teacher uses descriptive questions in facilitating learners’ access to terminology in the explanation of terms. The question is seeking learners’ conceptual understanding of the term ‘middle’
		RFQ	Also a ‘D’ in that the teacher uses learners’ responses to ask further questions and it suggests teacher’s level of response the IR2, prodding learners towards a predetermined definition of the term.
L1:72 Joy	Number in between	**PE**	It is an indication of ‘D’ practice and it suggests that the teacher accepts the meaning of the term in value form which is obtained from a procedural way.
L1:73 Teacher	In between what,	**RFQ**	A ‘D’ in that the teacher uses learners’ responses to ask further questions and it suggests teacher’s level of response the IR2/3, prodding learners towards a predetermined definition of the term.
	you said your median is what?	**QR ML**	This is indicative of ‘D’ practice in the classroom. It suggests that learners are involved in the definition of terms because the teacher asks a question intending to get a response from learners.
		DQ	‘D’ - descriptive question, it suggests that the teacher uses descriptive questions

			in facilitating learners' access to terminology in the explanation of terms. The question is seeking learners' conceptual understanding of the term 'median'
		QAS	'D' – which suggests IRE (initiation response evaluation type of presentation) (Scott et al., 2006), and a question and answer teaching strategy in the definition of terms.
L1:74 Joy	Number in between the one this side and the other that side	**PE** **IR2**	A procedural explanation, in defining the term and is of level IR2, is part of the 'D', it shows that this way of defining terms is accepted. Joy is describing where the median is found according to the data they are using and the teacher acknowledges it by reminding Joy to write it.
L1:75 Teacher	But you did not write it here, you have written sixty seven what is (...)	**BWRT**	A 'D' practice in the classroom. It suggests that learners write the definition of terms and follow a certain way of presenting work in their books which is accepted in the mathematics classroom (Gee, 2005).
		CLW	An indicative of 'D' practice in the classroom. It suggests that the teacher checks learners' work.
	or we want sixty seven and sixty two, right let's discuss in groups, two minutes	**GWS** **CIT1** **GD**	'D' – group work, it suggests teacher's teaching strategy which creates and engages learners in sound CIT1 pattern of interaction when teaching mathematical terms (Scott et al., 2006)
	what is the median and give me your answer (...) not at all,	**QR**	This is indicative of 'D' practice in the classroom. It suggests that learners are involved in the definition of terms because the teacher asks a question intending to get a response from learners.

		PQ	‘D’ - procedural question, it suggests that the teacher uses procedural questions in facilitating learners’ access to terminology in the procedural explanation of terms. This question is derived from an utterance of certain numbers by the teacher; therefore, it requires learners to explain a solution method of getting the median of that data.
		QAS	‘D’ – which suggests IRE (initiation response evaluation type of presentation) (Scott et al., 2006), and a question and answer teaching strategy in the definition of terms.
	the other thing you must write is a median in brackets Q2, in brackets Q2 (...), right next,	**BWRT**	A ‘D’ practice in the classroom. It suggests that learners write the definition of terms and follow a certain way of presenting work in their books which is accepted in the mathematics classroom (Gee, 2005).
	Q1 what is Q1, the first quartile and the minimum value, are they the same	**QR** **ML**	This is indicative of ‘D’ practice in the classroom. It suggests that learners are involved in the definition of terms because the teacher asks a question intending to get a response from learners.
		DQ	‘D’ - descriptive question, it suggests that the teacher uses descriptive questions in facilitating learners’ access to terminology in the explanation of terms. The question is seeking learners’ conceptual understanding of the terms ‘quartile’ and ‘minimum value’
		QAS	‘D’ – which suggests IRE (initiation response evaluation type of presentation) (Scott et al., 2006), and a question and answer teaching strategy in the definition of terms.

		DM	A practice in the 'D' which suggests that the teacher differentiate meanings of terms in the explanation.
L1:76 Joy	No		
L1:77 Teacher	You have written Q1 (...)	**BWRT**	A 'D' practice in the classroom. It suggests that learners write the definition of terms and follow a certain way of presenting work in their books which is accepted in the mathematics classroom (Gee, 2005).
	are you working as a group, you must work as a group, so discuss,	**GWS** **CIT1** **GD**	'D' – group work, it suggests teacher's teaching strategy which creates and engages learners in sound CIT1 pattern of interaction when teaching mathematical terms (Scott et al., 2006)
	what is the difference between first quartile and minimum value, third quartile and maximum value, okay,	**ML**	'd' in 'D' –English, a communication tool (Gee, 2005), this suggests that the teacher is using the mathematical language as a communication tool in the explanation of terms.
		DQ	'D' - descriptive question, it suggests that the teacher uses descriptive questions in facilitating learners' access to terminology in the explanation of terms. The question is seeking learners' conceptual understanding of a range of terms.
		DM	A practice in the 'D' which suggests that the teacher differentiate meanings of terms in the explanation.
		QR	This is indicative of 'D' practice in the classroom. It suggests that learners are involved in the definition of terms because the teacher asks a question intending

			to get a response from learners.
		QAS	'D' – which suggests IRE (initiation response evaluation type of presentation) (Scott et al., 2006), and a question and answer teaching strategy in the definition of terms.
	can I check your median, what is this, right median (...)	**CLW**	An indicative of 'D' practice in the classroom. It suggests that the teacher checks learners' work.
L1:78 Joy	Q2		
L1:79 Teacher	But you have not written anything for today, remember you are all learners no spectators, you must write, eeh I'm coming there, lower quartile, the median is correct, you say three, two, one... *ja* [yes] you have to write it down, after two months you would have forgotten, next, lower quartile	**BWRT**	A 'D' practice in the classroom. It suggests that learners write the definition of terms and follow a certain way of presenting work in their books which is accepted in the mathematics classroom (Gee, 2005).
		AC	'D' – This suggests that the teacher acknowledges and values learners' ideas when she says the median is correct.
L1:80 Learner	Three numbers after (...) find the lower quartile, the next Q1 okay between Q1 and (...)	**PE** **IR2**	A procedural explanation, in defining the term and is of level IR2, is part of the 'D', it shows that this way of defining terms is accepted. The learner is describing how lower quartile is found according to the data they are using.

L1:81 Teacher	You understand now, you have to divide the data into...	**ML**	'd' in 'D' –English, a communication tool (Gee, 2005), this suggests that the teacher is using the mathematical language as a communication tool in the explanation of terms.
		INCS	Leaving incomplete sentences is a way of talking the teacher allows (Gee, 2005); therefore, it is a 'D' practice she approves of because she allows learners to complete her incomplete sentence.
L1:82 Peter	Four	**BB**	'D' – learner interjection without being called upon is a practice in the classroom. It shows that blurting out behaviour is allowed because while the teacher was the learner L1:80 Peter finished the teacher's sentence.
L1:83 Teacher	Four *ja* {yes}	**AC**	'D' – This suggests that the teacher acknowledges and values learners' ideas.
L1:84 Peter	*Ihi forty six* {its forty six}	**PR**	It is an indication of 'D' practice and it suggests a procedural response from a learner and the teacher accepts the meaning of the term in value form which is obtained from a procedural way of finding median.
L1:85 Teacher	When you divide data into two parts then you get the median from there, take the first half, find the middle quartile, find range, lower quartile, upper quartile,	**IL**	An indication of an interactive/authoritative presentation of the teacher (Scott et al., 2006), i.e. a 'D' practice in the classroom. It suggests that learners are instructed to do some work.
		ML	'd' in 'D' –English, a communication tool (Gee, 2005), this suggests that the teacher is using the mathematical language as a communication tool in the explanation of terms.

		PE, IR2	A procedural explanation, in defining the term and is of level IR2, is part of the 'D', it shows that this way of defining terms is accepted.
	people write in full in your books, when you study you need to understand it, don't summarise here, write it in full [silence]	**BWRT**	A 'D' practice in the classroom. It suggests that learners write the definition of terms and follow a certain way of presenting work in their books which is accepted in the mathematics classroom (Gee, 2005).
L1:86 Teacher	Right, any group which have done the stem and leaf	**GWS CIT1**	'D' – group work, it suggests teacher's teaching strategy which creates and engages learners in sound CIT1 pattern of interaction when teaching mathematical terms (Scott et al., 2006)
		Art	Using artefacts is part of the 'D'; learners are expected to have their drawn stem and leaf on table in the process of explaining terms.
	I just want to check the stem and leaf now, there, there in that group	**CLW**	An indicative of 'D' practice in the classroom. It suggests that the teacher checks learners' work.
L1:87 Brenda	Here [raising hand up]		
L1:88 Teacher	Stem and leaf how did you get this,	**PQ**	'D' - procedural question, it suggests that the teacher uses procedural questions in facilitating learners' access to terminology in the procedural explanation of terms. The question "how did you get this" requires the learner to explain a solution method which gave the king of an answer.
		Art	Using artefacts is part of the 'D'; here learners are expected to be able to explain how they got the stem and leaf and in the process of explaining learners are

			giving their knowledge of terms which make up the stem and leaf.
	right thirty two divide by two now,	**PE**	A procedural explanation, in defining the term and is of level IR2, is part of the 'D', it shows that this way of defining terms is accepted.
	what is the median?	**QR**	This is indicative of 'D' practice in the classroom. It suggests that learners are involved in the definition of terms because the teacher asks a question intending to get a response from learners.
		QAS	'D' – which suggests IRE (initiation response evaluation type of presentation) (Scott et al., 2006), and a question and answer teaching strategy in the definition of terms.
		PQ	'D' - procedural question, it suggests that the teacher uses procedural questions in facilitating learners' access to terminology in the explanation of terms.
		ML	'd' in 'D' –English, a communication tool (Gee, 2005), this suggests that the teacher is using the mathematical language as a communication tool in the explanation of terms.
L1:89 Brenda	Number between numbers 36,6	**PE** **PR**	It is an indication of 'D' practice and it suggests a procedural response from a learner and the teacher accepts the meaning of the term in value form which is obtained from a procedural way of finding median.
L1:90 Teacher	Okay 36,6	**AC**	'D' – This suggests that the teacher acknowledges and values learners' ideas.
	okay can you count your data here, in the stem 10, good, can you arrange stem and leaf in a correct way, where is my pen, I	**IL** **ML**	An indication of an interactive/authoritative presentation of the teacher (Scott et al., 2006), i.e. a 'D' practice in the classroom. It suggests that learners are

	left it there		instructed to do some work.
		Art	Using artefacts is part of the 'D'; the teacher is using the stem and leaf in the explanation.
L1:91 Brenda	*Hasifuni lawa mafour four asiarrange ne* {we don't like these four fours let us arrange them, ok}	**NML**	'd' (Gee, 2005) in 'D' – non-mathematical language, this suggests that learners are allowed to communicate in their own languages at times
L1:92 Teacher	And then first quartile, *le* {this one} right do the discussions, eeh Brenda you must remind your group mates,	**GWS** **GD**	'D' – group work, it suggests teacher's teaching strategy which creates and engages learners in sound CIT1 pattern of interaction when teaching mathematical terms (Scott et al., 2006)
		CL	'D' - calling out learner's name, suggests a practice the teacher performs when a response form a learner is needed.
	they must label, don't just write eeh, also they should label that it is a stem and leaf, *ja* {yes} good uh is this quartile two	**BWRT**	A 'D' practice in the classroom. It suggests that learners write the definition of terms and follow a certain way of presenting work in their books which is accepted in the mathematics classroom (Gee, 2005).
L1:93 Brenda	No		
L1:94 Teacher	You see you must always check, Simon this is not quartile two, it is three, quartile two is there, divide your data into two,	**IL**	An indication of an interactive/authoritative presentation of the teacher (Scott et al., 2006), i.e. a 'D' practice in the classroom. It suggests that learners are instructed to do some work.

	take the first half divide into two, take the other half and divide into two again so that you get your quartile two, so please be careful okay, next stem and leaf	**ML**	'd' in 'D' –English, a communication tool (Gee, 2005), this suggests that the teacher is using the mathematical language as a communication tool in the explanation of terms.
		PE	A procedural explanation, in defining the term and is of level IR2, is part of the 'D', it shows that this way of defining terms is accepted.
L1:95 Learners	*Le* {This one}		
L1:96 Teacher	Right you have only done the median, something, what is this twenty three for, lower quartile, range, okay for number two eeh what do we have [to the class], you are supposed to do stem and leaf for number three, (...) you are rectifying number two	**IL**	An indication of an interactive/authoritative presentation of the teacher (Scott et al., 2006), i.e. a 'D' practice in the classroom. It suggests that learners are instructed to do some work.
		ML	'd' in 'D' –English, a communication tool (Gee, 2005), this suggests that the teacher is using the mathematical language as a communication tool in the explanation of terms.
		CIT2	A form of interaction in the 'D' which suggests that the teacher interacts with the whole class other than groups i.e. whole-class interaction (Scott et al., 2006)
L1:97 Brenda	Yes	**BB**	'D' – learner interjection without being called upon is a practice in the classroom. It shows that blurting out behaviour is allowed because while the teacher was still addressing the whole class L1:95, Brenda shouted for the class when she was not nominated.
L1:98 Teacher	When did you do it (...) with stem and leaf	**QR**	This is indicative of 'D' practice in the classroom. It suggests that learners are involved in the definition of terms because the teacher asks a question intending

			to get a response from learners.
		Art	Using artefacts is part of the 'D'; learners are expected to have their drawn stem and leaf.
L1:99 Learner	No, we did it there, stem and leaf *le* {this one}	**Art**	Using artefacts is part of the 'D'; the teacher insists on using the stem and leaf in the explanation.
L1:100 Teacher	Okay, you see that's why it is confusing, when you were writing you labelled it number 2, that is number three okay,	**CLW**	An indicative of 'D' practice in the classroom. It suggests that the teacher checks learners' work.
	continue doing the first quartile, third quartile, for number three, using stem and leaf, you can also do the next.	**ML**	'd' in 'D' –English, a communication tool (Gee, 2005), this suggests that the teacher is using the mathematical language as a communication tool in the explanation of terms.
		Art	Using artefacts is part of the 'D'; learners are expected to use their drawn stem and leaf to find value form of the terms
	Okay people, time up, go and finish your work and read again on quartiles in your textbooks to understand them see you tomorrow. [Learners run for the next lesson and we left the class last].	**ER STB**	This is indicative of 'D' practice in the classroom. It suggests that learners are encouraged to read about terms from the textbook, the teacher tells learners to read on quartiles in their textbooks. It also suggests that textbooks are used as sources of definition.

Lesson Two: Coded Transcript

Speaker	Utterance	Code	Comment
L2:1 Teacher	[The class monitor had collected and handed out learners' marked group work just before the lesson had started.	**GWS CIT1**	'D' – group work, it suggests teacher's teaching strategy which creates and engages learners in sound CIT1 pattern of interaction when teaching mathematical terms (Scott et al., 2006)
	Therefore, when we entered the classroom the noise which the learners were making was that of discussing their marked work, but as we entered the classroom the learners kept quiet with the	**CC**	Class control is an indication of 'D'; it suggests that the teacher draws learners' attention on what she is to teach … 'keeping quiet' suggests a culture the teacher has cultivated in the classroom (Gee, 2005)
	few who were still standing getting sited in their usual places (groups).	**GSB**	'D' –sitting in their usual places (groups facing the board), suggests teacher's classroom sitting arrangement and the interactive pattern, CIT1, (Scott et al., 2006), she approves of when teaching mathematical terms.
	The teacher stood this time in front but far left and talked to the learners].	**FC**	'D' - standing in front of the class, suggests teacher's teaching position when introducing terminology to the learners.
	Which group can present the stem and leaf of	**GWS CIT1**	'D' – group work, it suggests teacher's teaching strategy which creates and engages learners in sound CIT1 pattern of interaction when teaching mathematical terms (Scott et al., 2006)
	the data from previous work,	**RK**	Recapping previous work is a 'D' classroom practice which suggests that the teacher uses previously taught knowledge to introduce the lesson in defining the terms.

	Thabo	**CL**	'D' - calling out learner's name, suggests a practice the teacher performs when a response from a learner is needed.
L2:2 Thabo	[Goes to the chalk board, draws a stem and leaf on the board, writes an incorrect spelling of the word 'stem' and the class corrects him],	**LCB**	'D' - learner using the board, it shows that learners are allowed to write their ideas on the chalkboard, a classroom which is accepted by the teacher.
	ngu number bani lapha {what is the number here}	**NML**	'd' (Gee, 2005) in 'D' – non-mathematical language, this suggests that learners are allowed to communicate in their own languages at times
L2:3 Class	*Kunye, kubili, kubili* {one, two two}	**UR**	'D' – unison response, it suggests that this way of answering (Gee, 2005) is allowed by the teacher
		NML **CIT5**	'd' (Gee, 2005) in 'D' – non-mathematical language, this suggests that learners are allowed to communicate in their own languages at times
L2:4 Thabo	*Kuthathu, kuthathu, kuthathu, kuthathu, Kuthathu, kune, kuhlanu* {three, three, three, three, three, four, five}}[writing on the board]	**NML**	'd' (Gee, 2005) in 'D' – non-mathematical language, this suggests that learners are allowed to communicate in their own languages at times
L2:5 Teacher	Eh people I would say (…) you don't say one, two. three you would rather say eleven, twelve, thirteen just to use the correct numbers then, that way helps you to remember this, you then say twenty one, twenty three, okay	**ML**	'd' in 'D' –English, a communication tool (Gee, 2005), this suggests that the teacher insists using the mathematical language as a communication tool in the explanation of terms.
L2:6	Fourteen, fifteen, sixteen, seventeen, eighteen	**UR ML**	'D' – unison response, it suggests that this way of answering (Gee, 2005)

Class			is allowed by the teacher
L2:7 Nicole	*Ehe wena awuyibalanga* {you, you did not write it}	**BB**	'D' – learner interjection without being called upon is a practice in the classroom. It shows that blurting out behaviour is allowed because after the teacher had insisted the class on the use of the ML, Nicole shouted in a NML to Thabo as if she hadn't heard what the teacher was emphasising on.
		NML	'd' (Gee, 2005) in 'D' – non-mathematical language, this suggests that learners are allowed to communicate in their own languages at times
L2:8 Teacher	How many scores are there?	**QR ML**	This is indicative of 'D' practice in the classroom. It suggests that learners are involved in the definition of terms because the teacher asks a question intending to get a response from learners.
		QAS	'D' – which suggests IRE (initiation response evaluation type of presentation) (Scott et al., 2006), and a question and answer teaching strategy in the definition of terms.
L2:9 Class	Twenty four	**UR**	'D' – unison response, it suggests that this way of answering (Gee, 2005) is allowed by the teacher
L2:10 Thabo	[counting the scores to verify] *ja* {yes} twenty four		
L2:11 Teacher	Right, thank you,	**AC**	'D' – This suggests that the teacher acknowledges and values learners' ideas.

	your next question, Brenda	**CL**	'D' - calling out learner's name, suggests a practice the teacher performs when a response from a learner is needed.
L2:12 Brenda	I started like finding the mean of the scores…	**ML**	'd' in 'D' –English, a communication tool (Gee, 2005), this suggests that learners are supposed to using the mathematical language as a communication tool in the explanation of terms.
L2:13 Teacher	Scores		
L2:14 Brenda	Three and four, I look for my lower quartile then I found its twenty three, then my median is twenty three plus twenty four divide by two because lower quartile is also median	**TPD** **ML**	This is indicative of 'D', i.e. textbook procedures. It suggests that the teacher uses the textbook procedures in getting the meaning of terms in the explanation of the terms.
		PE **IR2**	A procedural explanation, in defining the term and is of level IR2, is part of the 'D', the learner is procedurally defining the lower quartile it shows that this way of defining terms is accepted.
L2:15 Class	No it is five	**UR**	'D' – unison response, it suggests that this way of answering (Gee, 2005) is allowed by the teacher
L2:16 Brenda	I find the median of the whole numbers, then I find the median of the half because median of the lower is the lower quartile	**TPD,** **ML** **CIT5**	This is indicative of 'D', i.e. textbook procedures. It suggests that the teacher uses the textbook procedures in getting the meaning of terms in the explanation of the terms.
		PE **IR2**	A procedural explanation, in defining the term and is of level IR2, is part of the 'D', it shows that this way of defining terms is accepted.

L2:17 Teacher	Please, please help her		
L2:18 Nicole	*Unamanga, ayisi,* [You are lying, it's not]	**NML**	'd' (Gee, 2005) in 'D' – non-mathematical language, this suggests that learners are allowed to communicate in their own languages at times
	it's not twenty three; it's fifteen plus sixteen…	**ML**	'd' in 'D' –English, a communication tool (Gee, 2005), this suggests that the teacher is using the mathematical language as a communication tool in the explanation of terms.
L2:19 Teacher	Eeh Joy	**CL**	'D' - calling out learner's name, suggests a practice the teacher performs when a response from a learner is needed.
	what did you write, what is your lower quartile,	**QR**	This is indicative of 'D' practice in the classroom. It suggests that learners are involved in the definition of terms because the teacher asks a question intending to get a response from learners.
		QAS	'D' – which suggests IRE (initiation response evaluation type of presentation) (Scott et al., 2006), and a question and answer teaching strategy in the definition of terms.
	how do you find the lower quartile	**QR** **ML**	This is indicative of 'D' practice in the classroom. It suggests that learners are involved in the definition of terms because the teacher asks a question intending to get a response from learners.
		QAS	'D' – which suggests IRE (initiation response evaluation type of presentation) (Scott et al., 2006), and a question and answer teaching strategy in the definition of terms.

		PQ	'D' - procedural question, it suggests that the teacher uses procedural questions in facilitating learners' access to terminology in the explanation of terms.
L2:20 Joy	I divided the positive two by two…	**TPD** **ML**	This is indicative of 'D', i.e. textbook procedures. It suggests that the teacher uses the textbook procedures in getting the meaning of terms in the explanation of the terms.
		PE **IR2**	A procedural explanation, in defining the term and is of level IR2, is part of the 'D', it shows that this way of defining terms is accepted.
L2:21 Teacher	Right	**AC**	'D' – This suggests that the teacher acknowledges and values learners' ideas.
	[with an encouragement hand gesture for the learner to continue]	**G**	'D' – Grammar 2 (Gee, 2005), in that the teacher uses gestures to accompany verbal communication. It suggests that the teacher approves of non-verbal communication in the explanation of the terms.
L2:22 Joy	Then I find …		
L2:23 Teacher	Remove the lower quartile, just do one thing at a time so that you are able to (...), good, eeh start with your median, remember we start with our median	**IL** **ML**	An indication of an interactive/authoritative presentation of the teacher (Scott et al., 2006), i.e. a 'D' practice in the classroom. It suggests that learners are instructed to do some work.

L2:24 Joy	We divide our data into two, then we calculate the median	**TPD** **ML**	This is indicative of 'D', i.e. textbook procedures. It suggests that the teacher uses the textbook procedures in getting the meaning of terms in the explanation of the terms.
		PE **IR2**	A procedural explanation, in defining the term and is of level IR2, is part of the 'D', it shows that this way of defining terms is accepted.
L2:25 Teacher	Right [encouraging again]	**AC**	'D' – This suggests that the teacher acknowledges and values learners' ideas.
L2:26 Joy	Then I look for the lower quartile I found that its twenty three	**PE** **IR2 ML**	A procedural explanation, in defining the term and is of level IR2, is part of the 'D', it shows that this way of defining terms is accepted.
L2:27 Teacher	Twenty three {re-voicing learner's utterance}	**RV**	'D' - which suggests teacher re-voices learners' answers (Enyedy et al., 2008) in the process of defining terms
L2:28 Joy	Yes		
L2:29 Teacher	How do you find the lower quartile tell us	**QR** **ML**	This is indicative of 'D' practice in the classroom. It suggests that learners are involved in the definition of terms because the teacher asks a question intending to get a response from learners.
		QAS	'D' – which suggests IRE (initiation response evaluation type of presentation) (Scott et al., 2006), and a question and answer teaching strategy in the definition of terms.

		PQ	'D' - procedural question, it suggests that the teacher uses procedural questions in facilitating learners' access to terminology in the explanation of terms.
L2:30 Joy	I jumped this number, then I got to [points at 3 in between 33 and 34 in row three]	**G**	'D' – Grammar 2 (Gee, 2005), in that the teacher uses gestures to accompany verbal communication. It suggests that the teacher approves of non-verbal communication in the explanation of the terms.
L2:31 Peter	No, no [with flying hands and head shaking in disagreement]	**BB**	'D' – learner interjection without being called upon is a practice in the classroom. It shows that blurting out behaviour is allowed because the teacher was still talking to Joy and Peter interjected yet he had not been called upon.
		G	'D' – Grammar 2 (Gee, 2005), in that the teacher uses gestures to accompany verbal communication. It suggests that the teacher approves of non-verbal communication in the explanation of the terms.
L2:32 Teacher	Yes Peter	**CL**	'D' - calling out learner's name, suggests a practice the teacher performs when a response from a learner is needed.
	[pointing at Peter giving him a chance to bring his idea]	**G**	'D' – Grammar 2 (Gee, 2005), in that the teacher uses gestures to accompany verbal communication. It suggests that the teacher approves of non-verbal communication in the explanation of the terms.

L2:33 Peter	Eeh in your (…), I must do, this is your half of your scores *le* {this one} and then get the half of the half of your scores and then you say [counting the scores)] okay go straight to the half of the eleven, one, two, three, four, five, six, seven, eight, nine, ten, eleven, (...), then here you count again [counting again from one to eleven looking into the textbook] because your scores are given there,	**TB**	This is indicative of 'D', i.e. textbook use. It suggests that the teacher uses a textbook in the explanation of the terms.
	therefore you take two numbers to get your middle number and then add them and divide by two and its going to be sixteen plus fifteen then you get thirty one divide by two which is equal to fifteen coma five and that means end quartile	**TPD** **ML**	This is indicative of 'D', i.e. textbook procedures. It suggests that the teacher uses the textbook procedures in getting the meaning of terms in the explanation of the terms. She gives a procedural explanation while looking into the textbook.
		PE **IR2**	A procedural explanation, in defining the term and is of level IR2, is part of the 'D', it shows that this way of defining terms is accepted.
L2:34 Stella	Lower quartile	**ML**	'd' in 'D' –English, a communication tool (Gee, 2005), this suggests that the learner is using the mathematical language as a communication tool in the explanation of terms.
L2:35 Peter	Lower quartile	**CIT4** **ML**	'D' - Learners interacting with each other suggests a practice teacher allows in class.

L2:36 Teacher	You understand Joy now, can you do the upper quartile for us	**CL** **ML**	'D' - calling out learner's name, suggests a practice the teacher performs when a response from a learner is needed.
L2:37 Joy	Upper quartile, for the upper quartile, I'm going to take the second half [pointing at the data set on the board]	**G** **ML**	'D' – Grammar 2 (Gee, 2005), in that the teacher uses gestures to accompany verbal communication. It suggests that the teacher approves of non-verbal communication in the explanation of the terms.
L2:38 Teacher	Good	**AC**	'D' – This suggests that the teacher acknowledges and values learners' ideas.
L2:39 Teacher	Who wants to come and do the range for us,	**CIT2** **ML**	A form of interaction in the 'D' which suggests that the teacher interacts with the whole class other than groups i.e. whole-class interaction (Scott et al., 2006)
		PQ	'D' - procedural question, it suggests that the teacher uses procedural questions in facilitating learners' access to terminology in the explanation of terms.
	every time you come across questions try and do them on your own the other questions that we had gone through, Joe	**CL**	'D' - calling out learner's name, suggests a practice the teacher performs when a response from a learner is needed.
L2:40 Joe	Yes, [coming to the board] the range, I find the highest number, for this one the range will be (...)	**PE** **IR2 ML**	A procedural explanation, in defining the term and is of level IR2, is part of the 'D', it shows that this way of defining terms is accepted.
	because it is the highest number that is given	**RCW**	Referring to chalkboard work is an indicative of a 'D' practice. It suggests that the teacher values chalkboard work as she does not condemn Joy who

	here [pointing at the board]		was pointing to the work at the board in her explanation of the terms.
L2:41 Teacher	Eeh yes Brenda,	**CL**	'D' - calling out learner's name, suggests a practice the teacher performs when a response from a learner is needed.
	Brenda what is the range?	**QR** **ML**	This is indicative of 'D' practice in the classroom. It suggests that learners are involved in the definition of terms because the teacher asks a question intending to get a response from learners.
		QAS	'D' – which suggests IRE (initiation response evaluation type of presentation) (Scott et al., 2006), and a question and answer teaching strategy in the definition of terms.
		PQ	'D' - procedural question, it suggests that the teacher uses procedural questions in facilitating learners' access to terminology in the explanation of terms.
L2:42 Brenda	Forty six		
L2:43 Teacher	And what is the inter quartile… [disagreeing with Brenda's answer]	**INCS** **ML**	Leaving incomplete sentences is a way of talking the teacher allows (Gee, 2005); therefore, it is a 'D' practice she approves of because she allows learners to complete her incomplete sentence.
		QR	This is indicative of 'D' practice in the classroom. It suggests that learners are involved in the definition of terms because the teacher asks a question intending to get a response from learners.

		QAS	'D' – which suggests IRE (initiation response evaluation type of presentation) (Scott et al., 2006), and a question and answer teaching strategy in the definition of terms.
		PQ	'D' - procedural question, it suggests that the teacher uses procedural questions in facilitating learners' access to terminology in the explanation of terms.
L2:44 Brenda	Range		
L2:45 Teacher	Range	**RV**	'D' - which suggests teacher re-voices learners' answers (Enyedy et al., 2008) in the process of defining terms
	[nodding her head]	**G**	'D' – Grammar 2 (Gee, 2005), in that the teacher uses gestures to accompany verbal communication. It suggests that the teacher approves of non-verbal communication in the explanation of the terms.
L2:46 Brenda	Fifty one	**PR**	It is an indication of 'D' practice and it suggests a procedural response from a learner and the teacher accepts the meaning of the term in value form which is obtained from a procedural way of finding range.
L2:47 Teacher	What was there [pointing at the data on the board], are you listening	**RCW**	Referring to chalkboard work is an indicative of a 'D' practice. It suggests that the teacher values chalkboard work as she was seen pointing to the work at the board in her explanation of the terms.

		G	'D' – Grammar 2 (Gee, 2005), in that the teacher uses gestures to accompany verbal communication. It suggests that the teacher approves of non-verbal communication in the explanation of the terms.
L2:48 Brenda	Yes, the inter quartile range	**ML**	'd' in 'D' –English, a communication tool (Gee, 2005), this suggests that the learner is using the mathematical language as a communication tool in the explanation of terms.
L2:49 Teacher	Ooh you have done everything, right, now people any problems with other questions, did you encounter any?	**CIT2**	A form of interaction in the 'D' which suggests that the teacher interacts with the whole class other than groups i.e. whole-class interaction (Scott et al., 2006)
L2:50 Nicole	Box and whiskers	**BB**	'D' – learner interjection without being called upon is a practice in the classroom. It shows that blurting out behaviour is allowed because Nicole just answered "Box and whiskers" when the teacher was still talking to Brenda and was not called upon.
L2:51 Teacher	Okay who can draw that box and whiskers for us on the board so that we can move on to (...), now you can move on to the next question, right box and whiskers	**RFQ**	A 'D' in that the teacher uses learners' responses to ask further questions and it suggests teacher's level of response the IR2, prodding learners towards a predetermined definition of the term.
		Art	Using artefacts is part of the 'D'; learners are expected to draw the box and whiskers on the board which can be used in the explanation of terms.
	who wants to come and draw it, can we have someone who wants to come and draw a box and whiskers who wants to come and draw the box	**LCB**	'D' - learner using the board, it shows that learners are allowed to write their ideas on the chalkboard, a classroom which is accepted by the teacher.

	and whiskers,	**ML**	‘d’ in ‘D’ –English, a communication tool (Gee, 2005), this suggests that the teacher is using the mathematical language as a communication tool in the explanation of terms.
	okay Lerato	**CL**	‘D’ - calling out learner’s name, suggests a practice the teacher performs when a response from a learner is needed.
	wants to come and…	**INCS**	Leaving incomplete sentences is a way of talking the teacher allows (Gee, 2005); therefore, it is a ‘D’ practice she approves of because she allows learners to complete her incomplete sentence.
L2:52 Lerato	Try [goes to the board and draws a box and whiskers]	**Art**	Using artefacts is part of the ‘D’; learner draws the diagram of the box and whiskers on the board to be used in the explanation of terms.
L2:53 Teacher	Try, okay that’s why you are here, try, can I just check, how did you draw your box and whiskers because there is a problem, who doesn’t understand, let me see, can I see what you have drawn, how you have drawn it, no Jackie, it can’t be, what must I correct, you must draw it so that I can correct it [to the learner who had not drawn anything], [moving around the groups] each one of you (...), still okay, correct, okay, who else has got a problem with a box and whiskers,	**CLW**	An indicative of ‘D’ practice in the classroom. It suggests that the teacher checks learners’ work.
	which group?	**GWS** **CIT1**	‘D’ – group work, it suggests teacher’s teaching strategy which creates and engages learners in sound CIT1 pattern of interaction when teaching

			mathematical terms (Scott et al., 2006)
L2:54 Stella	Us		
L2:55 Teacher	Which group, you, right okay let's look at what Brenda has drawn there,	**GWS CIT1**	'D' – group work, it suggests teacher's teaching strategy which creates and engages learners in sound CIT1 pattern of interaction when teaching mathematical terms (Scott et al., 2006)
		Art	Using artefacts is part of the 'D'; the chalkboard drawn diagram is used in the explanation of terms.
	your five number…	**INCS**	Leaving incomplete sentences is a way of talking the teacher allows (Gee, 2005); therefore, it is a 'D' practice she approves of because she allows learners to complete her incomplete sentence.
L2:56 Class	Summary	**UR**	'D' – unison response, it suggests that this way of answering (Gee, 2005) is allowed by the teacher
L2:57 Teacher	With your box and whiskers, that's what you show, your five number summary then you say minimum value, lower quartile, medium, upper quartile and maximum value,	**IL**	An indication of an interactive/authoritative presentation of the teacher (Scott et al., 2006), i.e. a 'D' practice in the classroom. It suggests that learners are instructed to do some work.
		BWRT	A 'D' practice in the classroom. It suggests that learners write the definition of terms and follow a certain way of presenting work in their books which is accepted in the mathematics classroom (Gee, 2005).

		ML	'd' in 'D' –English, a communication tool (Gee, 2005), this suggests that the teacher is using the mathematical language as a communication tool in the explanation of terms.
	right, so people try and draw it because most of you didn't draw it, okay I'm going to give you some five minutes to draw, but now people what we should do *ne* {ok} eeh try and use a scale,	**IL**	An indication of an interactive/authoritative presentation of the teacher (Scott et al., 2006), i.e. a 'D' practice in the classroom. It suggests that learners are instructed to do some work.
		CIT2	A form of interaction in the 'D' which suggests that the teacher interacts with the whole class other than groups i.e. whole-class interaction (Scott et al., 2006
	I will be coming to you and show you how to use a scale so that you can actually see whether your box and whiskers is symmetrical,	**HC**	Giving hints or clues is a 'D' practice which suggests that the teacher uses hints and clues to aid learners in the explanation of terms.
	is skewed to the left or skewed to the …	**INCS**	Leaving incomplete sentences is a way of talking the teacher allows (Gee, 2005); therefore, it is a 'D' practice she approves of because she allows learners to complete her incomplete sentence.
L2:58 Stella	Right		
L2:59 Teacher	Okay, so you can draw it using a free hand, sit down, it looks symmetrical but if, people you must use a ruler	**IL**	An indication of an interactive/authoritative presentation of the teacher (Scott et al., 2006), i.e. a 'D' practice in the classroom. It suggests that learners are instructed to do some work.

		CIT2	A form of interaction in the 'D' which suggests that the teacher interacts with the whole class other than groups i.e. whole-class interaction (Scott et al., 2006
	try and do some scale, don't, now if you look at the eeh, Brenda has drawn box and whiskers using free hand. Right? The information is misleading because look at your box and whiskers there, box is symmetrical but if you draw it it's not symmetrical. Right? In other words the difference between the lower quartile and the median is not equals to the difference between the	**BWRT ML**	A 'D' practice in the classroom. It suggests that learners write the definition of terms and follow a certain way of presenting work in their books which is accepted in the mathematics classroom (Gee, 2005).
	median and the ...	**INCS**	Leaving incomplete sentences is a way of talking the teacher allows (Gee, 2005); therefore, it is a 'D' practice she approves of because she allows learners to complete her incomplete sentence.
L2:60 Class	Upper quartile	**UR**	'D' – unison response, it suggests that this way of answering (Gee, 2005) is allowed by the teacher
L2:61 Teacher	So, let's use the ruler to draw a scale, okay draw,	**IL**	An indication of an interactive/authoritative presentation of the teacher (Scott et al., 2006), i.e. a 'D' practice in the classroom. It suggests that learners are instructed to do some work.

	did you see what I did there? [pointing to the board]	**RCW**	Referring to chalkboard work is an indicative of a 'D' practice. It suggests that the teacher values chalkboard work as she was seen pointing to the work at the board in her explanation of the terms.
		G	'D' – Grammar 2 (Gee, 2005), in that the teacher uses gestures to accompany verbal communication. It suggests that the teacher approves of non-verbal communication in the explanation of the terms.
L2:62 Nicole	No	**BB**	'D' – learner interjection without being called upon is a practice in the classroom. It shows that blurting out behaviour is allowed because Nicole interjected again.
L2:63 Teacher	Oh you have drawn it nicely, let's see, *ja* {yes} good but you must label,	**CLW**	An indicative of 'D' practice in the classroom. It suggests that the teacher checks learners' work.
	please show them, label, don't put five there, put five number summary, okay	**BWRT**	A 'D' practice in the classroom. It suggests that learners write the definition of terms and follow a certain way of presenting work in their books which is accepted in the mathematics classroom (Gee, 2005).
	next group, they are fine, you are also fine, I expect everyone to be drawing, people remember I told you, (...)	**GWS** **CIT1**	'D' – group work, it suggests teacher's teaching strategy which creates and engages learners in sound CIT1 pattern of interaction when teaching mathematical terms (Scott et al., 2006)
L2:65 Teacher	But it's always the same, right lets read here[looking in the textbook],	**STB**	This is indicative of 'D', i.e. source of definition. It suggests that the teacher uses a textbook as a source of definitions
	some books when they talk about skewed, they are saying a symmetrical data set is balanced or	**DS**	An indicative of 'D', i.e. source of definition. It suggests that the teacher also accepts different source of definitions

	you heard so, that it have to be exactly, exactly on either side of the median.	**ML**	‘d’ in ‘D’ –English, a communication tool (Gee, 2005), this suggests that the teacher is using the mathematical language as a communication tool in the explanation of terms.
	Note that, it doesn’t have to be exactly equal on both sides to be called symmetrical. This is good what you are doing, then calculate thirty three minus twenty three. It’s what? Twenty three coma five minus fifteen,	**PE** **IR2**	A procedural explanation, in defining the term and is of level IR2, is part of the ‘D’, it shows that this way of defining terms is accepted.
	so I want you to read the drawing, you must read about symmetrical, skewed to the right, skewed to the left, when is your box skewed to the left,	**ER**	This is indicative of ‘D’ practice in the classroom. It suggests that learners are encouraged to read about terms from the textbook,
	when is it skewed to the…	**INCS**	Leaving incomplete sentences is a way of talking the teacher allows (Gee, 2005); therefore, it is a ‘D’ practice she approves of because she allows learners to complete her incomplete sentence.
L2:66 Nicole	Right		
L2:67 Teacher	But note about symmetrical, you don’t have to get exactly. Do you understand?	**R**	A ‘D’ practice in the classroom which suggests that the teacher at times revisits ideas.
L2:68 Joy	Yes	**BB**	‘D’ – learner interjection without being called upon is a practice in the classroom. It shows that blurting out behaviour is allowed because while the teacher is still talking to Nicole Joy interjects before called upon by

			the teacher.
L2:69 Teacher	*Ja* {yes}, but then you must show the numbers, you know why you must show the numbers [referring to the box and whiskers on the board], because when I'm marking your papers	**RCW**	Referring to chalkboard work is an indicative of a 'D' practice. It suggests that the teacher values chalkboard work as she was seen pointing to the work at the board in her explanation of the terms.
		Art	Using artefacts is part of the 'D'; the chalkboard drawn diagram is used in the explanation of terms.
	I should be able to see that you know the minimum, don't write a lot of numbers, just show the minimum of the five number summary, show the lower quartile, show the median, show the upper quartile,	**ML**	'd' in 'D' –English, a communication tool (Gee, 2005), this suggests that the teacher is using the mathematical language as a communication tool in the explanation of terms.
	show the…	**INCS**	Leaving incomplete sentences is a way of talking the teacher allows (Gee, 2005); therefore, it is a 'D' practice she approves of because she allows learners to complete her incomplete sentence.
L2:70 Class	Maximum value	**UR ML**	'D' – unison response, it suggests that this way of answering (Gee, 2005) is allowed by the teacher
L2:71 Teacher	Maximum value.	**RV**	'D' - which suggests teacher re-voices learners' answers (Enyedy et al., 2008) in the process of defining terms

	Do you understand? So please people just go through the symmetrical data, eeh all of you today after you have drawn your box and whisker,	**CIT2**	A form of interaction in the 'D' which suggests that the teacher interacts with the whole class other than groups i.e. whole-class interaction (Scott et al., 2006)
	can I have your attention please,	**CC**	Class control is an indication of 'D'; it suggests that the teacher draws learners' attention on what she is to teach
	after you have finish drawing your box and whisker just turn on page one hundred and ninety four and read there about skewed and symmetrical data then analyse your box and whiskers, is it symmetrical, is it skewed to the right,	**STB**	This is indicative of 'D', i.e. source of definition. It suggests that the teacher uses a textbook as a source of definitions
		ML	'd' in 'D' –English, a communication tool (Gee, 2005), this suggests that the teacher is using the mathematical language as a communication tool in the explanation of terms.
		ER	This is indicative of 'D' practice in the classroom. It suggests that learners are encouraged to read about terms from the textbook,
	is it skewed to the…	**INCS**	Leaving incomplete sentences is a way of talking the teacher allows (Gee, 2005); therefore, it is a 'D' practice she approves of because she allows learners to complete her incomplete sentence.
L2:72 Class	Left	**UR**	'D' – unison response, it suggests that this way of answering (Gee, 2005) is allowed by the teacher
L2:73 Teacher	Right, people now let's move on to exercise eight coma ten, exercise eight coma ten, number one,	**TB**	This is indicative of 'D', i.e. textbook use. It suggests that the teacher uses a textbook in the explanation of terms.

	in your groups,	**GWS CIT1**	'D' – group work, it suggests teacher's teaching strategy which creates and engages learners in sound CIT1 pattern of interaction when teaching mathematical terms (Scott et al., 2006)
	people you must draw those box and whiskers and then analyse the data, i.e. whether it is skewed or symmetrical, people	**IL**	An indication of an interactive/authoritative presentation of the teacher (Scott et al., 2006), i.e. a 'D' practice in the classroom. It suggests that learners are instructed to do some work.
	just write on top there five number summary, stem and leaf (...), stem and leaf, five number summary, minimum value, maximum value, write everything to be clearer for you, you must write five number summary,	**BWRT ML**	A 'D' practice in the classroom. It suggests that learners write the definition of terms and follow a certain way of presenting work in their books which is accepted in the mathematics classroom (Gee, 2005).
	bring your book so that I can mark.	**CLW**	An indicative of 'D' practice in the classroom. It suggests that the teacher checks learners' work.
	Sam! Where is your five number summary, still, write it here	**CL**	'D' - calling out learner's name, suggests a practice the teacher performs when a response from a learner is needed.
L2:74 Sam	It is here.		
L2:75 Teacher	*Ja* {yes} but why do you squeeze it here, just write it here, write it neatly here, the five number summary , write here five number summary here,	**BWRT**	A 'D' practice in the classroom. It suggests that learners write the definition of terms and follow a certain way of presenting work in their books which is accepted in the mathematics classroom (Gee, 2005).

	Sam what are you laughing at, have you finished eight coma ten?	**CC**	Class control is an indication of 'D'; it suggests that the teacher draws learners' attention on what she is to teach
L2:76 Sam	No		
L2:77 Teacher	So why are you laughing [continues explaining to Sam] so you write five number summary, no you must write, you know what, you must write in your book so that when you look at your information after three months it gives you correct information, because if it is just numbers like this after three months (...), what did you say, what is this, you will have forgotten about it, you must write five number summary, minimum value, maximum value, the box and whiskers, label it box and whisker diagram so that you remember what it is, and don't call it thing and thing and thing, they have got their names	**BWRT**	A 'D' practice in the classroom. It suggests that learners write the definition of terms and follow a certain way of presenting work in their books which is accepted in the mathematics classroom (Gee, 2005).
		ML	'd' in 'D' –English, a communication tool (Gee, 2005), here the teacher is authoritatively telling (Scott et al., 2006) learners to use the mathematical language as they write the definitions of terms in their books.
L2:78 Nicole	They have given the scores	**BB**	'D' – learner interjection without being called upon is a practice in the classroom. It shows that blurting out behaviour is allowed because Nicole interjects before called upon by the teacher who is still talking to Sam.
L2:79 Teacher	Eeh people exercise eight coma ten, *ne* {okay},	**TB**	This is indicative of 'D', i.e. textbook use. It suggests that the teacher uses a textbook in the explanation of the terms.

	you have been given scores there as stem and leaf you don't have to re-write, right,	**BWRT ML**	A 'D' practice in the classroom. It suggests that learners write the definition of terms and follow a certain way of presenting work in their books which is accepted in the mathematics classroom (Gee, 2005).
	already stem and leaf is giving you what, the…	**INCS**	Leaving incomplete sentences is a way of talking the teacher allows (Gee, 2005); therefore, it is a 'D' practice she approves of because she allows learners to complete her incomplete sentence.
L2:80 Class	The scores	**UR**	'D' – unison response, it suggests that this way of answering (Gee, 2005) is allowed by the teacher
L2:81 Teacher	The scores from the smallest to the…	**INCS ML**	Leaving incomplete sentences is a way of talking the teacher allows (Gee, 2005); therefore, it is a 'D' practice she approves of because she allows learners to complete her incomplete sentence.
L2:82 Class	Highest	**UR**	'D' – unison response, it suggests that this way of answering (Gee, 2005) is allowed by the teacher
L2:83 Teacher	Highest,	**RV**	'D' - which suggests teacher re-voices learners' answers (Enyedy et al., 2008) in the process of defining terms
	do you understand, time management, hullo can I have your attention please, stem and leaf,	**CC**	Class control is an indication of 'D'; it suggests that the teacher draws learners' attention on what she is to teach
	your data already has been arranged in an ascending order okay, please time management it's also important because if you re-write things	**HC**	Giving hints or clues is a 'D' practice which suggests that the teacher uses hints and clues to aid learners in the explanation of terms.

	that are not necessary you won't finish the question okay, do you understand, so that data there is giving us stem and leaf,	**ML**	'd' in 'D' –English, a communication tool (Gee, 2005), this suggests that the teacher is using the mathematical language as a communication tool in the explanation of terms.
	just calculate your mean, median, whatever is asked there, okay	**TPD**	This is indicative of 'D', i.e. textbook procedures. It suggests that the teacher uses the textbook procedures in getting the meaning of terms (Ball, 1990), it also suggests that the teacher is practicing a Calculational Discourse (Setati, 2005b) in the explanation of the terms.
L2:84 Learner	Yes		
L2:85 Teacher	Right, don't re-write there, you should be finished by now,	**BWRT**	A 'D' practice in the classroom. It suggests that learners write the definition of terms and follow a certain way of presenting work in their books which is accepted in the mathematics classroom (Gee, 2005).
	how to calculate the middle, the middle, calculate, lets read our data, this is twelve, thirteen, fourteen, fifteen, sixteen, this is twenty, twenty, twenty one, twenty etc	**ML**	'd' in 'D' –English, a communication tool (Gee, 2005), this suggests that the teacher is using the mathematical language as a communication tool in the explanation of terms.
L2:86 Nicole	Yes	**BB**	'D' – learner interjection without being called upon is a practice in the classroom. It shows that blurting out behaviour is allowed because Nicole interjects again.
L2:87	That's your minimum value, that's your maximum value, *ne* {okay}, so find the middle,	**ML**	'd' in 'D' –English, a communication tool (Gee, 2005), this suggests that the teacher is using the mathematical language as a communication tool in

Teacher	divide the data into two, divide the data into two, uh, what are you calculating, uh no you don't have to add them you must count, just count one two three four remember what's this, this is twelve, thirteen, the first score is twelve, the second score thirteen, fourteen, fifteen, sixteen, sixteen, seventeen, do you understand		the explanation of terms.
		PE **IR2**	A procedural explanation, in defining the term and is of level IR2, is part of the 'D', it shows that this way of defining terms is accepted.
L2:88 Nicole	Yes		
L2:89 Teacher	Where is your textbook, please bring the textbook to class all the time,	**TB**	This is indicative of 'D', i.e. textbook use. It suggests that the teacher uses a textbook in the explanation of the terms.
	you see now if you had your textbook, you would be comparing how many did you get, but if you count as one like this it is a problem if you are wrong you are both wrong, do you see,	**STB**	This is indicative of 'D', i.e. source of definition. It suggests that the teacher uses a textbook as a source of definitions
	how many did you get	**QR**	This is indicative of 'D' practice in the classroom. It suggests that learners are involved in the definition of terms because the teacher asks a question intending to get a response from learners.
L2:90 Nicole	Thirty two		

L2:91 Teacher	*Ja* {yes} have you found the median	**QR ML**	This is indicative of 'D' practice in the classroom. It suggests that learners are involved in the definition of terms because the teacher asks a question intending to get a response from learners.
		PQ	'D' - procedural question, it suggests that the teacher uses procedural questions in facilitating learners' access to terminology in the explanation of terms.
L2:92 Joy	Yes	**BB**	'D' – learner interjection without being called upon is a practice in the classroom. It shows that blurting out behaviour is allowed because
L2:93 Teacher	Okay, try to find the median and then discuss it, check if it is correct	**PQ** **GD ML**	'D' - procedural question, it suggests that the teacher uses procedural questions in facilitating learners' access to terminology in the explanation of terms.
		IL	An indication of an interactive/authoritative presentation of the teacher (Scott et al., 2006), i.e. a 'D' practice in the classroom. It suggests that learners are instructed to do some work.
L2:94 Nicole	It's thirty five	**BB**	'D' – learner interjection without being called upon is a practice in the classroom. It shows that blurting out behaviour is allowed because Nicole interjects again as the teacher talks to Joy.
		PR	It is an indication of 'D' practice and it suggests a 'valued' procedural response from a learner and the teacher accepts the meaning of the term in value form which is obtained from a procedural way of finding median.
L2:95	It's what…	**INCS**	Leaving incomplete sentences is a way of talking the teacher allows (Gee,

Teacher			2005); therefore, it is a 'D' practice she approves of because she allows learners to complete her incomplete sentence.
L2:96 Nicole	It's thirty five	**PR**	It is an indication of 'D' practice and it suggests a 'valued'procedural response from a learner and the teacher accepts the meaning of the term in value form which is obtained from a procedural way of finding median.
L2:97 Teacher	Why is it thirty five	**IJ** **ML**	Justifying, a 'D' practice which identifies the talk in the classroom with that of mathematicians (Gee, 2005). It suggests that learners are expected to justify their ideas. Enforcing or encouraging some form of mathematical reasoning being.
L2:98 Nicole	Half is sixteen	**PR** **ML**	It is an indication of 'D' practice and it suggests a 'valued' procedural response from a learner and the teacher accepts the meaning of the term in value form which is obtained from a procedural way of finding median.
L2:99 Teacher	Sixteen, okay and thirty five, (-) okay let us see, you say half is sixteen,	**RV**	'D' - which suggests teacher re-voices learners' answers (Enyedy et al., 2008) in the process of defining terms
	sixteen it means the first sixteen and the last sixteen, so let us talk about thirty two, thirty two, is it an even number or an odd number	**BR**	Building on learners' responses is part of the 'D'; it suggests that the teacher uses learners' responses to prod further ideas in defining terms.
		QR **LQ**	This is indicative of 'D' practice in the classroom. It suggests that learners are involved in the definition of terms because the teacher asks a question intending to get a response from learners. Teacher asks leading question
		ML	'd' in 'D' –English, a communication tool (Gee, 2005), this suggests that the teacher is using the mathematical language as a communication tool in

			the explanation of terms.
L2:100 Nicole	Even number	**ML**	'd' in 'D' –English, a communication tool (Gee, 2005), this suggests that the learner is using the mathematical language as a communication tool in the explanation of terms
L2:101 Teacher	So if it is an even number what do we do	**BR, ML**	Building on learners' responses is part of the 'D', it suggests that the teacher uses learners' responses to prod further ideas in defining terms.
		PLQ	Teacher asks probing/leading question
L2:102 Nicole	We add the numbers and divide by two because we want to find the half of it	**PE, IR2 ML**	A procedural explanation, in defining the term and is of level IR2, is part of the 'D', it shows that this way of defining terms is accepted.
L2:103 Teacher	*Ja* {yes} we must take score number sixteen plus score number seventeen add them together and divide by two, is it what you did,	**RMD** **AE**	'D' – remoulding, it suggests that the teacher remoulds and adds to learner's explanations as she leads learners towards predetermined definitions. This is so because the teacher remoulds leaner's response using the textbook definition.
		PP	Paraphrasing learner's answer (Pressley et al, 1989) is an indication of a 'D' practice, here the teacher paraphrases learner's textbook descriptive definition of the term 'median'
		ML	'd' in 'D' –English, a communication tool (Gee, 2005), this suggests that the teacher is using the mathematical language as a communication tool in the explanation of terms.
		PE, IR2	A procedural explanation, in defining the term and is of level IR2, is part

			of the 'D', it shows that this way of defining terms is accepted.
	is it what you did [with a frontical gesture]	**G**	'D' – Grammar 2 (Gee, 2005), in that the teacher uses gestures to accompany verbal communication. It suggests that the teacher approves of non-verbal communication in the explanation of the terms.
L2:104 Nicole	Yes		
L2:105 Teacher	So which one is it	**QR**	This is indicative of 'D' practice in the classroom. It suggests that learners are involved in the definition of terms because the teacher asks a question intending to get a response from learners.
L2:106 Mike	Thirty five and thirty seven	**BB, ML**	'D' – learner interjection without being called upon is a practice in the classroom. It shows that blurting out behaviour is allowed because the teacher is still in an exchange with Nicole, Mike shouted the answer.
		PR	It is an indication of 'D' practice and it suggests a 'valued' procedural response from a learner and the teacher accepts the meaning of the term in value form which is obtained from a procedural way of finding meanings of the terms.
L2:107 Teacher	Thirty five and thirty seven divide by…	**INCS, PE, ML**	Leaving incomplete sentences is a way of talking the teacher allows (Gee, 2005); therefore, it is a 'D' practice she approves of because she allows learners to complete her incomplete sentence.
L2:108 Nicole	Two	**BB**	'D' – learner interjection without being called upon is a practice in the classroom. It shows that blurting out behaviour is allowed because while

			the teacher accepts and attends to Mike's interjection Nicole shouts as she finishes teacher's sentence.
L2:109 Teacher	Okay, write it,	**AC**	'D' – This suggests that the teacher acknowledges and values learners' ideas.
	you must write the formula median is equals to (-), you write the two numbers and	**F**	Using formula is indicative of 'D', i.e. some practice in the classroom. It suggests that the teacher facilitates learners' access to terminology through the procedural way.
		TPD	This is indicative of 'D', i.e. textbook procedures. It suggests that the teacher uses the textbook procedures in getting the meaning of terms in the explanation of the terms.
		BWRT	A 'D' practice in the classroom. It suggests that learners write the definition of terms and follow a certain way of presenting work in their books which is accepted in the mathematics classroom (Gee, 2005).
		ML	'd' in 'D' –English, a communication tool (Gee, 2005), this suggests that the teacher is using the mathematical language as a communication tool in the explanation of terms.
	divide by...	**INCS**	Leaving incomplete sentences is a way of talking the teacher allows (Gee, 2005); therefore, it is a 'D' practice she approves of because she allows learners to complete her incomplete sentence.

L2:110 Mike	Two	**BB**	'D' – learner interjection without being called upon is a practice in the classroom. It shows that blurting out behaviour is allowed because when the teacher goes back to Nicole, Mike shouted the answer as he also finishes teacher's sentence.
		PR	It is an indication of 'D' practice and it suggests that the teacher accepts the meaning of the term in value form which is obtained from a procedural way of finding median.
L2:111 Teacher	Two, okay	**AC**	'D' – This suggests that the teacher acknowledges and values learners' ideas.
L2:112 Mike	Thirty six	**PR**	It is an indication of 'D' practice and it suggests a 'valued' procedural response from a learner and the teacher accepts the meaning of the term in value form which is obtained from a procedural way of finding median.
L2:113 Teacher	Thirty six,	**RV**	'D' - which suggests teacher re-voices learners' answers (Enyedy et al., 2008) in the process of defining terms
	write it,	**AC**	'D' – This suggests that the teacher acknowledges and values learners' answer which is a value form of a definition of the term 'median'.
	okay, don't just write thirty six, write median equals to, (-)	**BWRT**	A 'D' practice in the classroom. It suggests that learners write the definition of terms and follow a certain way of presenting work in their books which is accepted in the mathematics classroom (Gee, 2005).

		ML	‘d’ in ‘D’ –English, a communication tool (Gee, 2005), this suggests that the teacher insists on the use of the mathematical language as a communication tool in the explanation of terms.
	now what’s the formula for the mean,	**QR** **F**	This is indicative of ‘D’ practice in the classroom. It suggests that learners are involved in the definition of terms because the teacher asks a question intending to get a response from learners. It also suggests that a formula is used to deliver the meaning of the term.
	go back and check the formula,	**IL**	An indication of an interactive/authoritative presentation of the teacher (Scott et al., 2006), i.e. a ‘D’ practice in the classroom. It suggests that learners are instructed to do some work.
	how did you write the formula, how do we write our formula	**QR**	This is indicative of ‘D’ practice in the classroom. It suggests that learners are involved in the definition of terms because the teacher asks a question intending to get a response from learners.
		QAS	‘D’ – which suggests IRE (initiation response evaluation type of presentation) (Scott et al., 2006), and a question and answer teaching strategy in the definition of terms.
		F	Using formula is indicative of ‘D’, i.e. some practice in the classroom. It suggests that the teacher facilitates learners’ access to terminology through a procedural way of using a formula.
L2:114 Mike	X bar is equal to the sum of...	**PR, TPD, IR2, F**	It is an indication of ‘D’ practice and it suggests a ‘valued’ procedural response from a learner and the teacher accepts the meaning of the term in value form which is obtained from a procedural way of finding meanings

		ML	of terms.
L2:115 Teacher	Good,	**AC**	‘D’ – This suggests that the teacher acknowledges and values learners’ ideas.
	x bar is equal to the sum of all squares	**RV, ML**	‘D’ - which suggests teacher re-voices learners’ answers (Enyedy et al., 2008) in the process of defining terms
		RMD, AE **F**	‘D’ – remoulding, it suggests that the teacher remoulds and adds to learner’s explanations as she leads learners towards predetermined definitions. This is so because the teacher remoulds leaner’s response using the textbook definition.
	[writing the formula on the chalkboard]	**WLI**	‘D’ – writing leaner idea on the board, suggest teacher’s interactive/authoritative approach (Scott et al., 2006), to teaching terminology
L2:116 Mike	Yes		
L2:117 Teacher	The mean not the median, this is the mean, why is it the mean not the median	**IJ** **ML**	Justifying, a ‘D’ practice which identifies the talk in the classroom with that of mathematicians (Gee, 2005). It suggests that learners are expected to justify their ideas. Instigating some form of mathematical reasoning.
		DQ	‘D’ - descriptive question, it suggests that the teacher uses descriptive questions in facilitating learners’ access to terminology in the explanation of terms. The question is seeking learners’ conceptual understanding of the terms ‘mean’ and ‘median’

		DM	A practice in the 'D' which suggests that the teacher differentiate meanings of terms in the explanation.
L2:118 Mike	Yes, it is the mean because it is from the formula	**PE, IR2 F, ML**	A procedural explanation, in defining the term and is of level IR2, is part of the 'D', it shows that this way of defining terms is accepted.
L2:119 Teacher	*Yo yo yoo* {no,no,no}	**NML**	'd' (Gee, 2005) in 'D' – non-mathematical language, this suggests that the teacher at times communicates with the learners in a non-mathematical language.
	[shaking her head disagreeing with the learner]	**G**	'D' – Grammar 2 (Gee, 2005), in that the teacher uses gestures to accompany verbal communication. It suggests that the teacher approves of non-verbal communication in the explanation of the terms.
	but how did you calculate the mean, ja {yes},	**QAS ML**	'D' – which suggests IRE (initiation response evaluation type of presentation) (Scott et al., 2006), and a question and answer teaching strategy in the definition of terms.
		PQ	'D' - procedural question, it suggests that the teacher uses procedural questions in facilitating learners' access to terminology in the explanation of terms.
	is it correct	**QR**	This is indicative of 'D' practice in the classroom. It suggests that learners are involved in the definition of terms because the teacher asks a question intending to get a response from learners.
L2:120 Mike	No		

L2:121 Teacher	No,	**RV**	'D' - which suggests teacher re-voices learners' answers (Enyedy et al., 2008) in the process of defining terms
	so how must you calculate the mean	**QR ML**	This is indicative of 'D' practice in the classroom. It suggests that learners are involved in the definition of terms because the teacher asks a question intending to get a response from learners.
		QAS	'D' – which suggests IRE (initiation response evaluation type of presentation) (Scott et al., 2006), and a question and answer teaching strategy in the definition of terms.
		PQ	'D' - procedural question, it suggests that the teacher uses procedural questions in facilitating learners' access to terminology in the explanation of terms.
	[hands gestures wanting to know how the mean is calculated]	**G**	'D' – Grammar 2 (Gee, 2005), in that the teacher uses gestures to accompany verbal communication. It suggests that the teacher approves of non-verbal communication in the explanation of the terms.
L2:122 Mike	You must use this formula which is x bar is equal to...	**PE, IR2 F, ML**	A procedural explanation, in defining the term and is of level IR2 because they are to use the formula, is part of the 'D'; it shows that this way of defining terms is accepted.
L2:123 Teacher	Yes you must use this formula	**RV, F ML**	'D' - which suggests teacher re-voices learners' answers (Enyedy et al., 2008) in the process of defining terms

	[pointing to the formula written on the board]	**RCW**	Referring to chalkboard work is an indicative of a 'D' practice. It suggests that the teacher values chalkboard work as she was seen pointing to the work at the board in her explanation of the terms.
		G	'D' – Grammar 2 (Gee, 2005), in that the teacher uses gestures to accompany verbal communication. It suggests that the teacher approves of non-verbal communication in the explanation of the terms.
L2:124 Mike	Ok		
L2:125 Teacher	Let us use our calculators, mode right, do you still remember that, mode...	**Art ML**	Using artefacts is part of the 'D'; it suggests that the teacher uses objects when explaining terms. The teacher is asking learners to use their calculators to find mean and is classified as procedural. The teacher is using mathematical language
L2:126 Mike	The steps or the number that is appearing the most because it is the mode of the numbers	**ML**	'd' in 'D' –English, a communication tool (Gee, 2005), this suggests that the learner is supposed to use the mathematical language as a communication tool in the explanation of terms.
L2:127 Teacher	Two		
L2:128 Mike	This one [points at two on his calculator]		
L2:129 Teacher	*Ja* {yes} two, then enter your scores, where are your calculators	**Art**	Learners are expected to have calculators

Lesson Four: Coded Transcript

Speaker	Utterance	Code	Comment
L4:1 Teacher	[We entered the classroom, this time learners were sited talking to each other but their voices were lowered. The teacher greeted the learners and ordered them to pull out their group past exam question papers and asked them to answer certain questions on statistical averages from those papers].	**GWS CIT1** **GSB**	'D' – group work, it suggests teacher's teaching strategy which creates and engages learners in sound CIT1 pattern of interaction when teaching mathematical terms (Scott et al., 2006)
	I want you to continue answering those questions from the exam papers, and then each group will present a solution of a question to the class.	**IL**	An indication of an interactive/authoritative presentation of the teacher (Scott et al., 2006), i.e. a 'D' practice in the classroom. It suggests that learners are instructed to do some work.
	Stop concentrating on your book, we all have eeh question papers, this is one of the typical exam questions, I want you to answer them after you have discussed with people in your group, I will be back after twenty five minutes, okay	**GWS CIT1** **GD**	'D' – group work, it suggests teacher's teaching strategy which creates and engages learners in sound CIT1 pattern of interaction when teaching mathematical terms (Scott et al., 2006)
L4:2 Class	Yes	**UR**	'D' – unison response, it suggests that this way of answering (Gee, 2005) is allowed by the teacher
L4:3	Try to select a person who is going to present, not all questions, I'm going to give a chance to	**IL**	An indication of an interactive/authoritative presentation of the teacher (Scott et al., 2006), i.e. a 'D' practice in the classroom. It

Teacher	each group to give us a solution to a question, Try as many questions as you can present.		suggests that learners are instructed to do some work.
	Are you discussing with your group? [leaving the class for a meeting]	**GWS CIT1, GD**	'D' – group work, it suggests teacher's teaching strategy which creates and engages learners in sound CIT1 pattern of interaction when teaching mathematical terms (Scott et al., 2006)
L4:4 Class	Yes	**UR**	'D' – unison response, it suggests that this way of answering (Gee, 2005) is allowed by the teacher

Appendix D: Teacher Interview Coded Transcript

Speaker	Utterance	Code	Comment
IQ1	**What do you consider as a better way of introducing mathematical terms to learners in your class?**	**Q1**	
P-R1	I think… is to assess where the learners are at first, what they already know about what I want to teach them…things like their prior knowledge,	**PK**	'D' – prior knowledge, a practice in the classroom. It suggests that learners' prior knowledge is assessed before new mathematical terms are taught to them.
	what they think the mathematical term I want to teach mean after saying and	**VT**	Term verbalising is an indication of 'D' in the classroom, it suggests that the teacher tells learners terms and asks them questions as she promotes exchanges in defining the terms.
	writing the term on the board.	**WTB**	'D' - chalkboard use, a classroom practice, which indicates that that the teacher writes the term on the board for learners to see and draw their attention to the term. A practice which suggests teacher's interactive/authoritative presentation of terms in class (Scott et al., 2006).
	I normally ask them questions relating to what I want to introduce or if we had done the main topic and maybe the term I want to teach is in the subtopic	**QR**	This is indicative of 'D' practice in the classroom. It suggests that learners are involved in the definition of terms because the teacher asks a question intending to get a response from learners.

		QAS	'D' – which suggests IRE (initiation response evaluation type of presentation) (Scott et al., 2006), and a question and answer teaching strategy in the definition of terms.
	I recap what I had taught them to lead to what I want to teach…what I have noticed with my learners is that when	**RK**	Recapping previous work is a 'D' classroom practice which suggests that the teacher uses previously taught knowledge to introduce the lesson in defining the terms.
	I write a mathematical term on the board which is not familiar to them they keep quiet and I know they do not know this term then,	**WTB**	'D' - chalkboard use, a classroom practice, which indicates that that the teacher writes the term on the board for learners to see and draw their attention to the term. A practice which suggests teacher's interactive/authoritative presentation of terms in class (Scott et al., 2006).
	if it needs a diagram for me to illustrate the term I draw it and	**WTB**	'D' - chalkboard use, a classroom practice, which indicates that that the teacher writes the term on the board for learners to see and draw their attention to the term. A practice which suggests teacher's interactive/authoritative presentation of terms in class (Scott et al., 2006).
	illustrate using the diagram.	**Art**	Using artefacts is part of the 'D'; the chalkboard drawn diagrams are used in the explanation of terms.

	If I definitely know, during my planning, that the term I am going to teach is very new, I bring all the necessary resources such as models or charts if I have them.	**Art**	Using artefacts is part of the ‘D’; models and charts if necessary are used in the explanation of terms.
	But sometimes when I write something on the board which they do have a clue about it,	**WTB**	‘D’ - chalkboard use, a classroom practice, which indicates that that the teacher writes the term on the board for learners to see and draw their attention to the term. A practice which suggests teacher’s interactive/authoritative presentation of terms in class (Scott et al., 2006).
	its normally shown by their facial expression…eh…	**E**	A facial expression, Grammar 2, is used to communicate (Gee, 2005), therefore, it is a ‘D’ practice. It suggests that the teacher approves of non-verbal communication in the explanation of the terms.
	I just switch to questions of wanting to know what they know about that. But for the topic I am teaching on five number summary (averages)	**QR**	This is indicative of ‘D’ practice in the classroom. It suggests that learners are involved in the definition of terms because the teacher asks a question intending to get a response from learners.
		QAS	‘D’ – which suggests IRE (initiation response evaluation type of presentation) (Scott et al., 2006), and a question and answer teaching strategy in the definition of terms.

	I first asked the learners to bring their last term's marks from 13 exercises be it a test, homework or class work so that we could work on the marks as our data.	**HW**	This is indicative of 'D' practice in the classroom. It suggests that learners are given homework in preparation of the next lesson.
		IL	An indication of an interactive/authoritative presentation of the teacher (Scott et al., 2006), i.e. a 'D' practice in the classroom. It suggests that learners are instructed to do some work.
	Because we were looking at averages I just asked them to find their average mark of the list	**PQ**	'D' - procedural question, it suggests that the teacher uses procedural questions in facilitating learners' access to terminology in the explanation of terms.
IQ2	**Do you use informal knowledge or formal knowledge when introducing or teaching mathematical terms and why would you use it**	**Q2**	
P-R2	You know what, I use both informal	**IK**	'D' – informal knowledge, a practice in the classroom which suggests that the teacher uses learners' everyday knowledge as a platform to teach terminology (Vygotsky, 1978; Moschkovich, 2003; Adams, 2003)
	and formal knowledge just like what I did when I introduced this topic	**FK**	Formal knowledge is a 'D' practice which indicates that the teacher explains the terms in a mathematical way (Moschkovich, 2003; Adams, 2003).

	I used their knowledge of general average…because	**PK**	‘D’ – prior knowledge, a practice in the classroom. It suggests that learners’ prior knowledge is assessed before new mathematical terms are taught to them.
	when they show that what I have written on the board is known to them I assume it’s informal or	**WTB**	‘D’ - chalkboard use, a classroom practice, which indicates that that the teacher writes the term on the board for learners to see and draw their attention to the term. A practice which suggests teacher’s interactive/authoritative presentation of terms in class (Scott et al., 2006).
	when I assume that they know something informally about what I want to teach I will ask them some questions and if I find that they have some correct mathematical definition of what I am teaching then it becomes easy for me to continue	**QR**	Question and response, this is indicative of ‘D’ practice in the classroom. It suggests that learners are involved in the definition of terms because the teacher asks a question intending to get a response from learners.
		QAS	‘D’ – which suggests IRE (initiation response evaluation type of presentation) (Scott et al., 2006), and a question and answer teaching strategy in the definition of terms.
	but I make sure I give them mathematical examples as I define and where and when the terms are used so that they get it straight and	**ML**	‘d’ in ‘D’ –English, a communication tool (Gee, 2005), this suggests that the teacher is using the mathematical language as a communication tool in the explanation of terms.

	I ask them to write the definition in their books in such a way that they do not forget its mathematical meaning compared to other meanings.	**BWRT**	A 'D' practice in the classroom. It suggests that learners write the definition of terms and follow a certain way of presenting work in their books which is accepted in the mathematics classroom (Gee, 2005).
	If the learners do not have any clue about what I am to teach I just go straight to formal mathematical meaning, though sometimes when necessary I use the informal… to help them understand if they are not getting it but I… normally go straight to formal mathematical meaning because I want the learners to get it straight from the mathematical point of view so that they do not mix ideas or the meanings and it is also easy for me to explain the terms…in a mathematics way as I understand them well that way.	**ML**	'd' in 'D' –English, a communication tool (Gee, 2005), this suggests that the teacher is using the mathematical language as a communication tool in the explanation of terms.
IQ3	**Looking at the whole topic you are teaching what terms did the learners get straight and what terms did they struggle with? What could be the reason?**	**Q3**	
P-R3	The words mean, mode and range were understood quite easily and they were easy to find than median and quartiles.	**TPD**	This is indicative of 'D', i.e. textbook procedures. It suggests that the teacher uses the textbook procedures in getting the meaning of terms in the explanation of the terms.

	I think they understood the first three because they are easy to calculate…for example mean is what they used to call average, mode being what appears most in their data	**TPD**	This is indicative of ‘D’, i.e. textbook procedures. It suggests that the teacher uses the textbook procedures in getting the meaning of terms in the explanation of the terms.
	and range, I taught them to think of it as the distance between the starting point and the end point of the data though	**IK**	‘D’ – informal knowledge, a practice in the classroom which suggests that the teacher uses learners’ everyday knowledge as a platform to teach terminology (Vygotsky, 1978; Moschkovich, 2003; Adams, 2003)
		DE	A descriptive explanation, a textbook descriptive definition of the term which is of level IR3 is part of the ‘D’. It suggests that the teacher accepts descriptive definition of terms in the explanation of terms.
	I was referring to the difference between the smallest and the largest value. Coming to the median and the quartiles,	**FK**	Formal knowledge is a ‘D’ practice which indicates that the teacher explains the terms in a mathematical way (Moschkovich, 2003; Adams, 2003).
		DE	A descriptive explanation, a textbook descriptive definition of the term which is of level IR3 is part of the ‘D’. It suggests that the teacher accepts descriptive definition of terms in the explanation of terms.

	I think their difficulty for median was when the number of numbers is even they sometimes get a value which is not in their data so they get confused but when the number of numbers is odd the median is easy to pick because it appears to be the middle number and for the quartiles as percentiles… normally they want to get the percentages as (25%, 50%, 75%) to show that they are in quarters, they do not know that it depends on the data they have…they compare data which they will be working on with a set of consecutive numbers and maybe because they cannot link these words with any of their everyday words so they do not readily get it.	**PE** **IR2**	A procedural explanation, in defining the term and is of level IR2, is part of the 'D', it shows that this way of defining terms is accepted.
		TPD	This is indicative of 'D', i.e. textbook procedures. It suggests that the teacher uses the textbook procedures in getting the meaning of terms in the explanation of the terms.
IQ4	**Do you borrow some definitions of the terms from other sources e.g. other textbooks, life situations or other people's definitions (verbal or texts). Why?**	**Q4**	
P-R4	I use any source of information available which can help me to make the learners understand, you know, the type of learners we have here are not from rich families where we assume they might have resources at home or to think they might get some help at home, they only get school knowledge from us teachers and not from anywhere,…we really struggle to get them understand what we are teaching so I should be resourceful myself in order to help them…also our school is not equipped like other schools which have computers for learners to get information its only me here as a teacher who have access to a computer not learners. I use definitions of different sources for example when I was teaching them about the	**DS**	An indicative of 'D', i.e. source of definition. It suggests that the teacher also accepts different source of definitions

	word data, for them to understand what data means		
	I send them in their groups, and these are permanent groups in that class,	**GWS** **CIT1** **GSB**	'D' – group work, it suggests teacher's teaching strategy which creates and engages learners in sound CIT1 pattern of interaction when teaching mathematical terms (Scott et al., 2006)
	to go and collect the following information for three days, group A, number of people in each family of 12 families; group B, number of learners in each class in our school; group C number of girls and group D number of boys in the classes here at school	**HW**	This is indicative of 'D' practice in the classroom. It suggests that learners are given homework in preparation of the next lesson.
	so that they know what is it that becomes data when they find it in their textbooks.	**STB**	This is indicative of 'D', i.e. source of definition. It suggests that the teacher uses a textbook as a source of definitions
	I also encourage my learners to go and ask other people especially teachers here at school even after I have taught them the terminology or to read around	**DS** **FI**	An indicative of 'D', i.e. source of definition. It suggests that the teacher also accepts different source of definitions and that, learners are free to source information around.
	and from the textbook for them to understand better other than just from me as their teacher and if they get something different they should come back and tell us in class what they have found different. I want them to be resourceful also.	**ER** **TB**	This is indicative of 'D' practice in the classroom. It suggests that learners are encouraged to read about terms from the textbook,

IQ5	**What do you consider as a proper definition of the mathematical term you teach? Why?**	**Q5**	
P-R5	Not to confuse my learners and also myself I stick to the mathematical definitions of the textbook only and because	**STB**	This is indicative of ‘D’, i.e. source of definition. It suggests that the teacher uses a textbook as a source of definitions
		ML	‘d’ in ‘D’ –English, a communication tool (Gee, 2005), this suggests that the teacher is using the mathematical language as a communication tool in the explanation of terms.
		LL	‘D’ – leads learners, a practice in the classroom. It suggests that the teacher leads learners through in the defining of terms.
	we teach towards examinations it is better to teach what is commonly accepted and we know what is commonly accepted is in the textbook…	**STB**	This is indicative of ‘D’, i.e. source of definition. It suggests that the teacher uses a textbook as a source of definitions
		ML	‘d’ in ‘D’ –English, a communication tool (Gee, 2005), this suggests that the teacher is using the mathematical language as a communication tool in the explanation of terms.

		LL	'D' – leads learners, a practice in the classroom. It suggests that the teacher leads learners through in the defining of terms.
	I want my learners not to get surprised when they hear the same word being used in different contexts they should know the mathematical meaning and be able to use it properly in mathematics.	**STB**	This is indicative of 'D', i.e. source of definition. It suggests that the teacher uses a textbook as a source of definitions
		ML	'd' in 'D' –English, a communication tool (Gee, 2005), this suggests that the teacher is using the mathematical language as a communication tool in the explanation of terms.
		LL	'D' – leads learners, a practice in the classroom. It suggests that the teacher leads learners through in the defining of terms.
IQ6	**Why were you using the language of instruction (language of mathematics) throughout your teaching?**	**Q6**	
P-R6	We do have learners who speak different languages, in addition, I even have foreign children from Zambia and Lesotho in that class, a lot are Zulus and I am a Xhosa, so I…find it unfair to use my language which will make a few to benefit and again I find myself confident in using English, it's easy for me because I did mathematics in English at school also.	**ML**	'd' in 'D' –English, a communication tool (Gee, 2005), this suggests that the teacher is using the mathematical language as a communication tool in the explanation of terms, for there are learners of different languages.

	Besides I want the learners to be confident and to get the definitions straight in the accepted language of mathematics so that they do not get confused when they come across the words in other subjects…they should be able to differentiate a mathematical meaning from other subjects' meanings of the same word.	**ML**	'd' in 'D' –English, a communication tool (Gee, 2005), this suggests that the teacher is using the mathematical language as a communication tool in the explanation of terms.
IQ7	**What classroom communications do you see effective in making the learners understand mathematical terms?**	**Q7**	
P-R7	I find group work and report back working well for me, as you just saw in most lessons,	**GWS** **CIT1**	'D' – group work, it suggests teacher's teaching strategy which creates and engages learners in sound CIT1 pattern of interaction when teaching mathematical terms (Scott et al., 2006)
	because even if I would have explained the definition… learners need to discuss on their own and with this	**GD**	Group discussion an indication of 'D' in the class room. It indicates that learners are allowed to discuss the meanings of terms in their groups.
	they share their understandings and they do that using their languages…	**NML**	'd' (Gee, 2005) in 'D' – non-mathematical language, this suggests that learners are allowed to communicate in their own languages at times
	…and it helps those who would have missed during my teaching. Another communication they get the terms better is when I use examples, models or go out of class like what they did to go and collect their own data for them to understand what data is.	**Art**	Using artefacts is part of the 'D'; models and examples if necessary are used in the explanation of terms.

	And terms whose meanings can be demonstrated… if there is a demonstration to accompany the word most of them understand it very well though I cannot give an example of such word now.	**G**	'D' – Grammar 2 (Gee, 2005), in that the teacher uses gestures to accompany verbal communication. It suggests that the teacher approves of non-verbal communication in the explanation of the terms.
	But normally I write the term on the board	**WTB**	'D' - chalkboard use, a classroom practice, which indicates that that the teacher writes the term on the board for learners to see and draw their attention to the term. A practice which suggests teacher's interactive/authoritative presentation of terms in class (Scott et al., 2006).
	and ask questions, and when they give some responses	**QR**	This is indicative of 'D' practice in the classroom. It suggests that learners are involved in the definition of terms because the teacher asks a question intending to get a response from learners.
		QAS	'D' – which suggests IRE (initiation response evaluation type of presentation) (Scott et al., 2006), and a question and answer teaching strategy in the definition of terms.
	I might use the responses to ask more questions as a follow-up…or	**RFQ**	A 'D' in that the teacher uses learners' responses to ask further questions and it suggests teacher's level of response the IR2/3, prodding learners towards a predetermined definition of the term.

		BR	Building on learners' responses is part of the 'D', it suggests that the teacher uses learners' responses to prod further ideas in defining terms as the teacher indicates that she may use learners' responses to ask further questions.
	I ask them to read from the textbook and explain to the class their understanding of the terms…then	**ER** **IL** **TB**	This is indicative of 'D' practice in the classroom. It suggests that learners are encouraged to read about terms from the textbook, because the teacher asks learners to read from their text books and explain to the class.
	I finalise by explaining the term	**SD**	Summing-up classroom deliberations are an indication of 'D', it suggests that the teacher is the leader and knows when to close up discussions. It also suggests that predetermined definitions are given by the teacher because she indicates that she finalises by explaining the term according to the textbook.
	according to the textbook we are using in class.	**STB**	This is indicative of 'D', i.e. source of definition. It suggests that the teacher uses a textbook as a source of definitions because the teacher finalises by explaining the term according to the textbook

Appendix E: Data Analysis

Tabulated Like Terms

Speaker	**Utterance**	**Code**	**Comment**
L1:16 Teacher	Okay	**AC**	'D' – This suggests that the teacher acknowledges and values learners' ideas.
L1:18 Teacher	right median	**AC**	'D' – This suggests that the teacher acknowledges and values learners' ideas by saying "right median" and asked for its abbreviation. Teacher is evaluating learners' response.
L1:24 Teacher	Right,	**AC**	'D' – This suggests that the teacher accepts descriptive explanation of the term by acknowledging it "Right", it also shows that she values learners' ideas. Evaluates learners answer.
L1:28 Teacher	okay	**AC**	'D' – This suggests that the teacher acknowledges and values learners' ideas.
L1:34 Teacher	right,	**AC**	'D' – This suggests that the teacher acknowledges and values learners' ideas.
L1:36 Teacher	Right,	**AC**	'D' – This suggests that the teacher acknowledges and values learners' ideas.
L1:49 Teacher	Right	**AC**	'D' – This suggests that the teacher acknowledges and values learners' ideas.
L1:59	right who is done with	**AC**	'D' – This suggests that the teacher acknowledges and values learners' ideas.

Teacher	number 2a,		
L1:79 Teacher	the median is correct, you say three, two, one...	**AC**	'D' – This suggests that the teacher acknowledges and values learners' ideas when she says the median is correct.
L1:83 Teacher	Four *ja* {yes}	**AC**	'D' – This suggests that the teacher acknowledges and values learners' ideas.
L1:90 Teacher	Okay 36,6	**AC**	'D' – This suggests that the teacher acknowledges and values learners' ideas.
L2:11 Teacher	Right, thank you,	**AC**	'D' – This suggests that the teacher acknowledges and values learners' ideas.
L2:21 Teacher	Right	**AC**	'D' – This suggests that the teacher acknowledges and values learners' ideas
L2:25 Teacher	Right [encouraging again]	**AC**	'D' – This suggests that the teacher acknowledges and values learners' ideas.
L2:38 Teacher	Good	**AC**	'D' – This suggests that the teacher acknowledges and values learners' ideas.
L2:109 Teacher	Okay, write it,	**AC**	'D' – This suggests that the teacher acknowledges and values learners' ideas.
L2:111 Teacher	Two, okay	**AC**	'D' – This suggests that the teacher acknowledges and values learners' ideas.

L2:113 Teacher	write it,	**AC**	'D' – This suggests that the teacher acknowledges and values learners' answer which is a value form of a definition of the term 'median'.
L2:115 Teacher	Good,	**AC**	'D' – This suggests that the teacher acknowledges and values learners' ideas.

The illustration in this table is that:

- The teacher was acknowledging learners' ideas.
- The acknowledgements were fairly distributed in the whole of Lessons 1 and 2 as is depicted by the turns in the first column, but this did not happen in Lesson 4 mainly because the teacher gave learners work to do in groups as she left the class for a meeting.
- The frequency of teacher acknowledging learners' contributions was fairly high in both the lessons, and because of this, it can be assumed the data shows that the teacher acknowledges and values learners' ideas (Gee, 2005) when defining terms.
- The teacher uses ordinary language in most utterances than the mathematical language in lines L1:18 and L1:79 when acknowledging learners' ideas.
- The mostly used word in the acknowledgements is 'right' implying that the teacher had established a norm in the class that when learners contribute positive to what is being taught she appreciate their efforts regardless of a repetitive use of a word. It also implies that the teacher creates a social teaching environment which is conducive to learning and the class becomes a community of mathematics participants (Gee, 2005).
- Also implied is that the acknowledgements were used as an encouragement mode for learners to participate and contribute to their learning of mathematical terminology, thus participating in the construction of their own knowledge of the mathematical terms (Webb & Webb, 2008; Lobato et al., 2005)

Speaker	**Utterance**	**Code**	**Comment**
L1:86 Teacher	Right, any group which have done the stem and leaf	**Art**	Using artefacts is part of the 'D'; learners are expected to have their drawn stem and leaf on table in the process of explaining terms.

L1:88 Teacher	Stem and leaf how did you get this	**Art**	Using artefacts is part of the 'D'; here learners are expected to be able to explain how they got the stem and leaf and in the process of explaining learners are giving their knowledge of terms which make up the stem and leaf.
L1:90 Teacher	okay can you count your data here, in the stem 10, good, can you arrange stem and leaf in a correct way,	**Art**	Using artefacts is part of the 'D'; the teacher is using the stem and leaf in the explanation.
L1:98 Teacher	When did you do it (...) with stem and leaf	**Art**	Using artefacts is part of the 'D'; the teacher insists on using the stem and leaf in the explanation.
L1:99 Learner	No, we did it there, stem and leaf *le* {this one}	**Art**	Using artefacts is part of the 'D'; learners are expected to have their drawn stem and leaf.
L1:100 Teacher	continue doing the first quartile, third quartile, for number three, using stem and leaf	**Art**	Using artefacts is part of the 'D'; learners are expected to use their drawn stem and leaf to find value form of the terms
L2:55 Teacher	Which group, you, right okay let's look at what Brenda has drawn there	**Art**	Using artefacts is part of the 'D'; the chalkboard drawn diagram is used in the explanation of terms.
L2:125 Teacher	Let us use our calculators, mode right, do you still remember that, mode...	**Art**	Using artefacts is part of the 'D'; it suggests that the teacher uses objects when explaining terms. The teacher is asking learners to use their calculators to find mean and is classified as procedural
L2:129 Teacher	*Ja* {yes} two, then enter your scores, where are your calculators	**Art**	Learners are expected to have calculators

P-R1	I draw it and illustrate using the diagram.	**Art**	Using artefacts is part of the 'D'; the chalkboard drawn diagrams are used in the explanation of terms.
	I bring all the necessary resources such as models or charts if I have them.	**Art**	Using artefacts is part of the 'D'; models and charts if necessary are used in the explanation of terms.
P-R7	when I use examples, models or go out of class like what they did to go and collect their own data	**Art**	Using artefacts is part of the 'D'; models and examples if necessary are used in the explanation of terms.

What this table illustrates is that:

- The teacher used the diagrams of stem and leaf and calculators as artefacts in the explanation of mathematical terms.
- The teacher use of artefacts occurred in lessons 1 and 2; towards the end of lesson 1, the middle of lesson 2 and towards the end of lesson 2. This seem to imply that artefacts are used when it's necessary because they were not used in the whole of the lessons, the data shows that some terms were explained without the use of artefacts e.g. the term 'range' (see transcript). The use of artefacts did not take place in lesson 4 because it was not necessary, for the learners were attempting question paper questions.
- The teacher's emphasis on learners having drawn diagrams in their books and on the chalkboard as the observed data shows implies that the teacher uses artefacts and has a belief (Gee, 2005) that they play a very important role in the facilitation of learners' access to mathematical terminology.
- The use of stem and leaf to find the first quartile and third quartile, for number three, in L1:100 shows that learners effectively access meanings of those terms procedurally and also implied is that the source of definition is the textbook.
- The importance in the use of artefacts was also emphasised on by the teacher as shown by the interview data. The teacher indicated that she draws diagrams to illustrate some points in the learning of terms, brings models and charts when necessary or put examples, this implies that the teacher uses specific artefacts in the process of defining the mathematical terms to the learners, thus, using objects (Gee, 2005) such as models to help learners master the given mathematical definitions of terms.
- As seen in the text (column 2), the teacher uses mathematical language, it implies that the teacher uses mathematical language when teaching.

Speaker	Utterance	Code	Comment
L1:9 Nicho	We only look to three first quartile	**BB**	'D' – learner interjection without being called upon is a practice in the classroom. It shows that blurting out behaviour is allowed because Nicho interjected while the teacher was still talking to Joy and did not condemn it instead the teacher-learner exchanges were now between the teacher and Nicho.
L1:46 Learner	Fifty two... the range	**BB**	'D' – learner interjection without being called upon is a practice in the classroom. It shows that blurting out behaviour is allowed because the learner shouted out the answer without being called upon.
L1:82 Peter	Four	**BB**	'D' – learner interjection without being called upon is a practice in the classroom. It shows that blurting out behaviour is allowed because while the teacher was the learner L1:80 Peter finished the teacher's sentence.
L1:97 Brenda	Yes	**BB**	'D' – learner interjection without being called upon is a practice in the classroom. It shows that blurting out behaviour is allowed because while the teacher was still addressing the whole class L1:95, Brenda shouted for the class when she was not nominated.
L2:7 Nicole	*Ehe wena awuyibalanga* {you, you did not write it}	**BB**	'D' – learner interjection without being called upon is a practice in the classroom. It shows that blurting out behaviour is allowed because after the teacher had insisted the class on the use of the ML, Nicole shouted in a NML to Thabo as if she hadn't heard what the teacher was emphasising on.
L2:31 Peter	No, no [with flying hands and head shaking in disagreement]	**BB**	'D' – learner interjection without being called upon is a practice in the classroom. It shows that blurting out behaviour is allowed because the teacher was still talking to Joy and Peter interjected yet he had not been called upon.
L2:50	Box and whiskers	**BB**	'D' – learner interjection without being called upon is a practice in the classroom. It shows that blurting

Nicole			out behaviour is allowed because Nicole just answered "Box and whiskers" when the teacher was still talking to Brenda and was not called upon.
L2:62 Nicole	No	**BB**	'D' – learner interjection without being called upon is a practice in the classroom. It shows that blurting out behaviour is allowed because Nicole interjected again.
L2:68 Joy	Yes	**BB**	'D' – learner interjection without being called upon is a practice in the classroom. It shows that blurting out behaviour is allowed because while the teacher is still talking to Nicole, Joy interjects before called upon by the teacher.
L2:78 Nicole	They have given the scores	**BB**	'D' – learner interjection without being called upon is a practice in the classroom. It shows that blurting out behaviour is allowed because Nicole interjects before called upon by the teacher who is still talking to Sam..
L2:86 Nicole	Yes	**BB**	'D' – learner interjection without being called upon is a practice in the classroom. It shows that blurting out behaviour is allowed because Nicole interjects again.
L2:92 Joy	Yes	**BB**	'D' – learner interjection without being called upon is a practice in the classroom. It shows that blurting out behaviour is allowed because Joy interjects again.
L2:94 Nicole	It's thirty five	**BB**	'D' – learner interjection without being called upon is a practice in the classroom. It shows that blurting out behaviour is allowed because Nicole interjects again as the teacher talks to Joy.
L2:106 Mike	Thirty five and thirty seven	**BB**	'D' – learner interjection without being called upon is a practice in the classroom. It shows that blurting out behaviour is allowed because the teacher is still in an exchange with Nicole, Mike shouted the answer.
L2:108	Two	**BB**	'D' – learner interjection without being called upon is a practice in the classroom. It shows that blurting out behaviour is allowed because while the teacher accepts and attends to Mike's interjection Nicole

Nicole			shouts as she finishes teacher’s sentence.
L2:110 Mike	Two	**BB**	‘D’ – learner interjection without being called upon is a practice in the classroom. It shows that blurting out behaviour is allowed because when the teacher goes back to Nicole, Mike shouted the answer as he also finishes teacher’s sentence.

The illustration in this table is that:

- Learners are blurting out their ideas without being called by the teacher.
- The blurting out of ideas was fairly distributed in the whole of lessons 1 and 2 as is depicted by the turns in the first column, but this did not happen in lesson 4 mainly because the teacher gave learners work to do in groups as she left the class for a meeting.
- Blurting out behaviour occurred in both lessons implying that the teacher accepted the behaviour. The frequency of the behaviour was higher in lesson 2 than in lesson 1, and in this case, it is assumed the data shows that learners were more assertive in lesson 2 than in lesson 1. Also implied is that the teacher knows the assertiveness of her learners, therefore, needs to accept the behaviour in the definition of terms.
- Learners used mathematical language in most utterances than ordinary language in lines L1:97, L2:7, L2:62, L2:68, L2:86 and L2:92 when interjecting and the teacher did not condemn it; this implies that the teacher created a social learning environment for learners and thus making the class a community of mathematics participants (Gee, 2005).
- Of the learners who interjected, Nicole dominated in lesson 2 and this implied that she was a very assertive learner and she might have been absent in lesson 1 because she was not among the interjectors of lesson 1. Nicole’s presence in lesson 2 made the frequency of the blurting out behaviour higher than that of lesson 1. By not condemning the behaviour the teacher seemed to indicate it was part of classroom Discourse
- Also implied is that the acceptance of the behaviour was used as an encouragement mode for learners to participate and contribute to their learning of mathematical terminology, thus participating in the construction of their own knowledge of the mathematical terms (Webb & Webb, 2008; Lobato et al., 2005)

Speaker	Utterance	Code	Comment
L1:59 Teacher	…you must write quartile, median, range or... what? please don't just write anything you don't know,	**BWRT**	A 'D' practice in the classroom. It suggests the teacher insist on learners to write some work on the definition of terms and follow a certain way of presenting work in their books which is accepted in the mathematics classroom (Gee, 2005).
L1:75 Teacher	But you did not write it here, you have written sixty seven what is (...)	**BWRT**	A 'D' practice in the classroom. It suggests the teacher insist learners to write some work on the definition of terms and follow a certain way of presenting work in their books which is accepted in the mathematics classroom (Gee, 2005).
	the other thing you must write is a median in brackets Q2, in brackets Q2 (...),	**BWRT**	A 'D' practice in the classroom. It suggests the teacher insist learners to write some work on the definition of terms and follow a certain way of presenting work in their books which is accepted in the mathematics classroom (Gee, 2005).
L1:77 Teacher	You have written Q1 (...)	**BWRT**	A 'D' practice in the classroom. It suggests the teacher insist learners to write some work on the definition of terms and follow a certain way of presenting work in their books which is accepted in the mathematics classroom (Gee, 2005).
L1:79 Teacher	But you have not written anything for today, remember you are all learners no spectators, you must write, eeh I'm coming there, lower quartile, the median is correct, you say three, two, one... *ja* [yes] you have to write it down, after two	**BWRT**	A 'D' practice in the classroom. It suggests the teacher insist learners to write some work on the definition of terms.

	months you would have forgotten		
L1:85 Teacher	people write in full in your books, when you study you need to understand it, don't summarise here, write it in full [silence]	**BWRT**	A 'D' practice in the classroom. It suggests the teacher insist learners to write some work on the definition of terms and follow a certain way of presenting work in their books which is accepted in the mathematics classroom (Gee, 2005).
L1:92 Teacher	they must label, don't just write eeh, also they should label that it is a stem and leaf,	**BWRT**	A 'D' practice in the classroom. It suggests the teacher insist learners to write some work on the definition of terms and follow a certain way of presenting work in their books which is accepted in the mathematics classroom (Gee, 2005).
L2:57 Teacher	show your five number summary then you say minimum value, lower quartile, medium, upper quartile and maximum value,	**BWRT**	A 'D' practice in the classroom. It suggests the teacher insist learners to write some work on the definition of terms and follow a certain way of presenting work in their books which is accepted in the mathematics classroom (Gee, 2005).
L2:59 Teacher	Okay, so you can draw it using a free hand, sit down, it looks symmetrical but if, people you must use a ruler try and do some scale, don't, now if you look at the eeh, Brenda has drawn box and whiskers using free hand. Right?	**BWRT**	A 'D' practice in the classroom. It suggests the teacher insist learners to write some work on the definition of terms and follow a certain way of presenting work in their books which is accepted in the mathematics classroom (Gee, 2005).
L2:63 Teacher	Oh you have drawn it nicely, let's see, *ja* {yes} good but you must label, please show them, label, don't put five there, put five number summary,	**BWRT**	A 'D' practice in the classroom. It suggests the teacher insist learners to write some work on the definition of terms and follow a certain way of presenting work in their books which is accepted in the mathematics classroom (Gee, 2005).

L2:73 Teacher	just write on top there five number summary, stem and leaf (...), stem and leaf, five number summary, minimum value, maximum value, write everything to be clearer for you, you must write five number summary,	**BWRT**	A 'D' practice in the classroom. It suggests the teacher insist learners to write some work on the definition of terms and follow a certain way of presenting work in their books which is accepted in the mathematics classroom (Gee, 2005).
L2:75 Teacher	*Ja* {yes} but why do you squeeze it here, just write it here, write it neatly here, the five number summary , write here five number summary here	**BWRT**	A 'D' practice in the classroom. It suggests the teacher insist learners to write some work on the definition of terms and follow a certain way of presenting work in their books which is accepted in the mathematics classroom (Gee, 2005).
L2:77 Teacher	so you write five number summary, no you must write, you know what, you must write in your book so that when you look at your information after three months it gives you correct information, because if it is just numbers like this after three months (...),	**BWRT**	A 'D' practice in the classroom. It suggests the teacher insist learners to write some work on the definition of terms and follow a certain way of presenting work in their books which is accepted in the mathematics classroom (Gee, 2005).
L2:79 Teacher	you have been given scores there as stem and leaf you don't have to re-write, right,	**BWRT**	A 'D' practice in the classroom. It suggests the teacher insist learners to write some work on the definition of terms and follow a certain way of presenting work in their books which is accepted in the mathematics classroom (Gee, 2005).
L2:85 Teacher	Right, don't re-write there, you should be finished by now,	**BWRT**	A 'D' practice in the classroom. It suggests the teacher insist learners to write some work on the definition of terms and follow a certain way of presenting work in their books which is accepted in the mathematics classroom (Gee, 2005).

L2:109 Teacher	you must write the formula median is equals to (-), you write the two numbers and	**BWRT**	A 'D' practice in the classroom. It suggests the teacher insist learners to write some work on the definition of terms and follow a certain way of presenting work in their books which is accepted in the mathematics classroom (Gee, 2005).
L2:113 Teacher	okay, don't just write thirty six, write median equals to, (-)	**BWRT**	A 'D' practice in the classroom. It suggests the teacher insist learners to write some work on the definition of terms and follow a certain way of presenting work in their books which is accepted in the mathematics classroom (Gee, 2005).
P-R2	I ask them to write the definition in their books in such a way that they do not forget its mathematical meaning compared to other meanings.	**BWRT**	A 'D' practice in the classroom. It suggests the teacher insist learners to write some work on the definition of terms and follow a certain way of presenting work in their books which is accepted in the mathematics classroom (Gee, 2005).

What this table illustrates is that:

- The teacher instructs learners to write the work on definition of terms in their books and insists on a certain way of presenting it.
- From the data, learners were asked to write in their books as from the middle of each lesson (1 and 2) till to the end as shown by the turns in the first column, it can be assumed the data shows that the teacher asks learners to write some work on the definition of terms after the teaching of those terms has taken place. No writing of work in books took place in lesson 4.
- There were more turns of teacher's insistence on work writing in lesson 2 than in 1 implying that the teacher consolidates her explanations of the terms by making sure all learners have written down the explanations for their future references in knowledge construction and deeper understanding of the meanings.
- The teacher used the mathematical language in the utterances this suggests that the teacher uses mathematical language in defining the mathematical terms as a resource in the explanation. Gee (2005) considers language creates a political view when people talk and write.
- The emphasis by the teacher on work writing implies that when defining mathematical terms learners must write or record down what they are doing, this is indicated by the utterance, "But you have not written anything for today, remember you are all learners no

spectators, you must write" L1:79. It also implies that the teacher facilitates learners' understanding of the terminology by making sure learners have written the work on defining terms.

- In most turns the teacher would tell learners how to write, what to write/show, what not to write in their books and what to use as they write the work, because of this, it is assumed the implication is that the teacher has her own ways of thinking, feeling, believing and valuing what she is teaching (Gee, 2005). Also the teacher has a certain classroom practice which defines the uniqueness of the community in her mathematics classroom. That is, the way she wants her work presented by the learners as she defines the terms makes the class a different community from other mathematics classrooms taught by other teachers. She wants her learners to arrange their work "in such a way that they do not forget its mathematical meaning compared to other meanings" (P-R2). Her argument is vivid in all the lines in the table as she instructs learners on how to present the work.
- Also implied is that the teacher evaluates learners' understanding of terminology in the written work.

Speaker	**Utterance**	**Code**	**Comment**
L1:1 Teacher	[When the teacher and I entered the classroom, most learners were making noise, and those who were not sited ran to take their places, some learner went and rubbed the board…	**CB**	The big 'D' discourse – clean chalkboard, it suggest a norm and a practice (Gee, 2005) of the class to use a clean chalkboard. Because a learner was seen rubbing the board before teaching took place without being asked to do so.

What this table illustrates is that:

- A learner cleans the chalkboard in the first minutes of the lesson, and what is implied here is that the teacher has put a norm that the chalkboard has to be clean before the lesson starts.

Speaker	**Utterance**	**Code**	**Comment**
L1:1 Teacher	…and came back to join the others. The teacher walked around and learners were seen putting away some non-mathematical items e.g. books…	**CC**	Class control is an indication of 'D'; it suggests that the teacher draws learners' attention on what she is to teach … 'putting away some non-mathematical items' suggests a culture the teacher has cultivated in the classroom (Gee, 2005). The teacher walked around

			the class and learners put away some items.
L2:1 Teacher	Therefore, when we entered the classroom the noise which the learners were making was that of discussing their marked work, but as we entered the classroom the learners kept quiet with the	**CC**	Class control is an indication of 'D'; it suggests that the teacher draws learners' attention on what she is to teach … 'keeping quiet' suggests a culture the teacher has cultivated in the classroom (Gee, 2005)
L2:71 Teacher	can I have your attention please,	**CC**	Class control is an indication of 'D'; it suggests that the teacher draws learners' attention on what she is to teach
L2:75 Teacher	Sam what are you laughing at, have you finished eight coma ten?	**CC**	Class control is an indication of 'D'; it suggests that the teacher draws learners' attention on what she is to teach
L2:83 Teacher	do you understand, time management, hullo can I have your attention please, stem and leaf,	**CC**	Class control is an indication of 'D'; it suggests that the teacher draws learners' attention on what she is to teach

What this table illustrates is that:

- The teacher was at the centre of classroom control and it showed that it was only the teacher who was controlling the classroom. There is no learner utterance where the learner is trying to keep order in the classroom. As seen in the text (column 2), the teacher uses ordinary language and not mathematical language to control the class.
- Classroom control occurred in lesson 1 and 2 only.
- The frequency of this happening was very low and in this case, it is assumed the data shows that this was a very well behaved class.
- Classroom control occurred in line l1:1, implying that learners were well behaved in lesson 1 than in lesson 2. In lesson 2 there 4 occasions where the teacher had to keep order. Also implied is that towards the end of the lesson (L2:71, 75 and 83) the learners were becoming restless because most of the controlling order utterances happened during that time.

Speaker	**Utterance**	**Code**	**Comment**
L1:7 Teacher	right, what else, Joy	**CL**	'D' - call out learner's name, suggests a practice the teacher performs when a response from a learner is needed, she called on Joy to give her idea. It could be a way of ensuring discipline and getting learners to pay attention.
L1:92 Teacher	And then first quartile, *le* {this one} right do the discussions, eeh Brenda you must remind your group mates,	**CL**	'D' - calling out learner's name, suggests a practice the teacher performs when a response from a learner is needed
L2:1 Teacher	Which group can present the stem and leaf of the data from previous work, Thabo	**CL**	'D' - calling out learner's name, suggests a practice the teacher performs when a response from a learner is needed.
L2:11 Teacher	Right, thank you, your next question, Brenda	**CL**	'D' - calling out learner's name, suggests a practice the teacher performs when a response from a learner is needed
L2:19 Teacher	Eeh Joy	**CL**	'D' - calling out learner's name, suggests a practice the teacher performs when a response from a learner is needed.
L2:32 Teacher	Yes Peter	**CL**	'D' - calling out learner's name, suggests a practice the teacher performs when a response from a learner is needed.
L2:36 Teacher	You understand Joy now, can you do the upper quartile for us	**CL**	'D' - calling out learner's name, suggests a practice the teacher performs when a response from a learner is needed.
L2:39 Teacher	Who wants to come and do the range for us, every time you come across questions try and do them on your own	**CL**	'D' - calling out learner's name, suggests a practice the teacher performs when a response from a learner is needed.

	the other questions that we had gone through, Joe		
L2:41 Teacher	Eeh yes Brenda,	**CL**	'D' - calling out learner's name, suggests a practice the teacher performs when a response from a learner is needed.
L2:51 Teacher	who wants to come and draw it, can we have someone who wants to come and draw a box and whiskers who wants to come and draw the box and whiskers, okay Lerato	**CL**	'D' - calling out learner's name, suggests a practice the teacher performs when a response from a learner is needed.
L2:73 Teacher	Sam! Where is your five number summary, still, write it here	**CL**	'D' - calling out learner's name, suggests a practice the teacher performs when a response from a learner is needed.

What this table illustrates is that:

- The teacher involved learners in the definition of mathematical terms by calling learners' names to respond.
- Calling upon learners' names occurred in lesson 1 and 2 only; it is assumed the data shows that the teacher would sometimes call upon learners' names; this was so because when she asked a question she would call a learner's name for response though the turns for calling learners were very few in comparison to whole lesson turns.
- The frequency of this happening was higher in lesson 2 than in lesson 1; in this case, it is assumed the data shows that learners were more active in lesson 2 than in lesson 1.
- It was only the teacher who called upon learners' names, no learner called upon another learner, which could imply that it was a way of ensuring discipline and getting learners to pay attention.

Speaker	Utterance	Code	Comment
L1:38 Teacher	I will be moving in your groups checking ,	**CLW**	An indicative of ‘D’ practice in the classroom. It suggests that the teacher checks learners’ work.
L1:47 Teacher	where is your book [checking learner’s work]	**CLW**	An indicative of ‘D’ practice in the classroom. It suggests that the teacher checks learners’ work.
L1:71 Teacher	let me see, seventy eight, sixty nine and which did you add extra it seems you have other one extra,	**CLW**	An indicative of ‘D’ practice in the classroom. It suggests that the teacher checks learners’ work.
L1:75 Teacher	But you did not write it here, you have written sixty seven what is (...)	**CLW**	An indicative of ‘D’ practice in the classroom. It suggests that the teacher checks learners’ work.
L1:77 Teacher	can I check your median, what is this, right median (...)	**CLW**	An indicative of ‘D’ practice in the classroom. It suggests that the teacher checks learners’ work.
L1:86 Teacher	I just want to check the stem and leaf now, there, there in that group	**CLW**	An indicative of ‘D’ practice in the classroom. It suggests that the teacher checks learners’ work.
L1:100 Teacher	Okay, you see that’s why it is confusing, when you were writing you labelled it number 2, that is number three okay,	**CLW**	An indicative of ‘D’ practice in the classroom. It suggests that the teacher checks learners’ work.
L2:53 Teacher	can I just check, how did you draw your box and whiskers because there is a problem,	**CLW**	An indicative of ‘D’ practice in the classroom. It suggests that the teacher checks learners’ work.
L2:63 Teacher	Oh you have drawn it nicely, let’s see, *ja* {yes} good but you must label,	**CLW**	An indicative of ‘D’ practice in the classroom. It suggests that the teacher checks learners’ work.

L2:73 Teacher	bring your book so that I can mark.	**CLW**	An indicative of ‘D’ practice in the classroom. It suggests that the teacher checks learners’ work.

What this table illustrates is that:

- The teacher makes a follow up on learners’ written work; this implies that the teacher checks learners’ work on definition of terms. Also implied is that the teacher checks work presentation in learners’ books as she evaluates their understanding of the terminology.
- Checking learners’ work occurred in lessons 1 and 2 only implying that in these lessons learners wrote some work on definition of terms and the teacher used both ordinary language and mathematical language.

Speaker	**Utterance**	**Code**	**Comment**
L1:100 Teacher	go and finish your work and read again on quartiles in your textbooks to understand them	**ER**	This is indicative of ‘D’ practice in the classroom. It suggests that learners are encouraged to read about terms from the textbook, the teacher tells learners to read on quartiles in their textbooks.
L2:65 Teacher	I want you to read the drawing, you must read about symmetrical, skewed to the right, skewed to the left, when is your box skewed to the left,	**ER**	This is indicative of ‘D’ practice in the classroom. It suggests that learners are encouraged to read about terms from the textbook,
L2:71 Teacher	turn on page one hundred and ninety four and read there about skewed and symmetrical data then analyse your box and whiskers, is it symmetrical, is it skewed to the right,	**ER**	This is indicative of ‘D’ practice in the classroom. It suggests that learners are encouraged to read about terms from the textbook,
P-R4	to read around and from the textbook for them to understand better other than just from me as	**ER**	This is indicative of ‘D’ practice in the classroom. It suggests that

	their teacher		learners are encouraged to read about terms from the textbook,
P-R7	I ask them to read from the textbook and explain to the class their understanding of the terms…	**ER**	This is indicative of 'D' practice in the classroom. It suggests that learners are encouraged to read about terms from the textbook, because the teacher asks learners to read from their text books and explain to the class.

What this table illustrates is that:

- The teacher encouraged learners to read about terms from the textbook, this implies that the teacher uses the textbook as the source of definitions. Also implied is that the teacher facilitates learners' access to terminology through the use of the textbook by encouraging them to read for themselves and construct their own understanding.
- The encouragement occurred in both lessons 1 and 2 where explanation of terms took place and the teacher used both ordinary language and not mathematical language. The encouragement did not occur in lesson 4 because there the teacher asked learners to answer question from a question paper.

Speaker	**Utterance**	**Code**	**Comment**
L1:1 Teacher	The teacher went in front far right and spoke].	**FC**	'D' - standing in front of the class, suggests teacher's teaching position when introducing terminology to the learners because the teacher went to the front of the class before talking to learners.
L2:1 Teacher	The teacher stood this time in front but far left and talked to the learners].	**FC**	'D' - standing in front of the class, suggests teacher's teaching position when introducing terminology to the learners.

What this table illustrates is that:

- The teacher uses the front of the classroom when teaching learners. This suggests that the teacher needs to control the class; therefore, she must be in a position where she can see every learner and be seen and heard by every learner as she conducts her lesson.

Speaker	**Utterance**	**Code**	**Comment**
P-R4	I also encourage my learners to go and ask other people especially teachers here at school even after I have taught them the terminology or to read around	**FI**	An indicative of 'D' allowing learners to discuss/talk to each other and other people. It suggests that the teacher also accepts different source of definitions and that, learners are free to source information around.

What this table illustrates is that:

- The teacher gives learners freedom to discuss or talk to each other or other people as they seek information about the terms. This suggests that the teacher accepts different sources of definitions.

Speaker	**Utterance**	**Code**	**Comment**
P-R2	I use … formal knowledge just like what I did when I introduced this topic	**FK**	Formal knowledge is a 'D' practice which indicates that the teacher explains the terms in a mathematical way (Moschkovich, 2003; Adams, 2003).
P-R3	I was referring to the difference between the smallest and the largest value. Coming to the median and the quartiles,	**FK**	Formal knowledge is a 'D' practice which indicates that the teacher explains the terms in a mathematical way (Moschkovich, 2003; Adams, 2003).

This table indicates:

- The use of formal knowledge, it suggests that the teacher uses formal knowledge when explaining the mathematical terms.

Speaker	Utterance	Code	Comment
L1:1 Teacher	[…and sat quietly in groups facing the board waiting for the teacher's opening instruction of the lesson].	**GSB**	'D' – sitting in groups facing the board, suggests teacher's classroom sitting arrangement and the interactive pattern, CIT1, (Scott et al., 2006), she approves of when teaching mathematical terms. Learners were observed seated in groups facing to the front.
L1:42 Teacher	why are you five in one group [insisting on four in a group]	**GSB**	'D' – group work, it suggests teacher's teaching strategy which creates and engages learners in sound CIT1 pattern of interaction when teaching mathematical terms (Scott et al., 2006)
L2:1 Teacher	[few who were still standing getting sited in their usual places (groups)].	**GSB**	'D' –sitting in their usual places (groups facing the board), suggests teacher's classroom sitting arrangement and the interactive pattern, CIT1, (Scott et al., 2006), she approves of when teaching mathematical terms.
L4:1 Teacher	The teacher greeted the learners and ordered them to pull out their group past exam question papers	**GSB**	'D' – group work, it suggests teacher's teaching strategy which creates and engages learners in sound CIT1 pattern of interaction when teaching mathematical terms (Scott et al., 2006)
P-R4	I send them in their groups, and these are permanent groups in that class,	**GSB**	'D' – group work, it suggests teacher's teaching strategy which creates and engages learners in sound CIT1 pattern of interaction when teaching mathematical terms (Scott et al., 2006)

This table indicates that:

- The teacher addresses learners as in groups facing the board. This implies that the teacher's classroom sitting arrangement is in groups. Also implied is group-teacher interaction as a teaching strategy which creates and engages learners in sound pattern of interaction when teaching mathematical terms (Scott et al., 2006).

- Addressing learners' in groups occurred in all the lessons implying that the classroom interaction taking place in this class is CIT1 as the interview data (P-R4) indicated that the groups are permanent.

Speaker	Utterance	Code	Comment
L1:1 Teacher	I gave you some data to go and study,	**HW**	This is indicative of 'D' practice in the classroom. It suggests that learners are given homework in preparation of the next lesson; the teacher indicated that she had given learners some data to go and work on in groups prior to current lesson.
P-R1	I first asked the learners to bring their last term's marks from 13 exercises be it a test, homework or class work so that we could work on the marks as our data.	**HW**	This is indicative of 'D' practice in the classroom. It suggests that learners are given homework in preparation of the next lesson.
P-R4	to go and collect the following information for three days, group A, number of people in each family of 12 families; group B, number of learners in each class in our school; group C number of girls and group D number of boys in the classes here at school	**HW**	This is indicative of 'D' practice in the classroom. It suggests that learners are given homework in preparation of the next lesson.

What this table illustrates is that:

- Learners are given work to do before the next lesson. It suggests that the teacher sometimes gives learners homework in preparation for the next lesson.

Speaker	Utterance	Code	Comment
L1:10	Three, why three and	**IJ**	Justifying, a 'D' practice which identifies the talk in the classroom with that of

Teacher	not...		mathematicians (Gee, 2005). It suggests that learners are expected to justify their ideas because the teacher asked Nicho “why three” ”. Also some form of mathematical reasoning being enforced or encouraged.
L2:97 Teacher	Why is it thirty five	**IJ**	Justifying, a ‘D’ practice which identifies the talk in the classroom with that of mathematicians (Gee, 2005). It suggests that learners are expected to justify their ideas. Enforcing or encouraging some form of mathematical reasoning being.
L2:117 Teacher	The mean not the median, this is the mean, why is it the mean not the median	**IJ**	Justifying, a ‘D’ practice which identifies the talk in the classroom with that of mathematicians (Gee, 2005). It suggests that learners are expected to justify their ideas. Instigating some form of mathematical reasoning.

What this table illustrates is that:

- The teacher asked learners questions which solicited justification. It suggests that learners are sometimes expected to justify their ideas and also implied is that the teacher instigated some form of mathematical reasoning.
- Questions soliciting justification occurred in lessons 1 and 2 (not in 4) because classroom interactions on explanation of terms took place in the 2 lessons only and in her questions the teacher used the mathematical language which implies that the teacher uses mathematical language when explaining mathematical terms.

Speaker	**Utterance**	**Code**	**Comment**
P-R2	You know what, I use … informal knowledge	**IK**	‘D’ – informal knowledge, a practice in the classroom which suggests that the teacher uses learners’ everyday knowledge as a platform to teach terminology (Vygotsky, 1978; Moschkovich, 2003; Adams, 2003)
P-R3	…and range I taught them to think of it as the distance between the starting	**IK**	‘D’ – informal knowledge, a practice in the classroom which suggests that the teacher uses learners’ everyday knowledge as a platform to teach

	point and the end point of the data though		terminology (Vygotsky, 1978; Moschkovich, 2003; Adams, 2003)

This table indicates:

- The use of informal knowledge, it suggests that the teacher sometimes uses informal knowledge when necessary in the explanation of mathematical terms, though, there was no observed indication of such in the lessons.

Speaker	**Utterance**	**Code**	**Comment**
L1:36 Teacher	Right, I want you in your groups (...) on the data; find the range and the five number…	**IL**	An indication of an interactive/authoritative presentation of the teacher (Scott et al., 2006), i.e. a 'D' practice in the classroom. It suggests that learners are instructed to do some work.
L1:42 Teacher	Arrange the data in ascending order, quickly do that,	**IL**	An indication of an interactive/authoritative presentation of the teacher (Scott et al., 2006), i.e. a 'D' practice in the classroom. It suggests that learners are instructed to do some work.
L1:45 Teacher	Quickly calculate it	**IL**	An indication of an interactive/authoritative presentation of the teacher (Scott et al., 2006), i.e. a 'D' practice in the classroom. It suggests that learners are instructed to do some work.
L1:69 Teacher	Its true fifty? [in disbelief] can you put your hand on top of fifty, count this side then that side,	**IL**	An indication of an interactive/authoritative presentation of the teacher (Scott et al., 2006), i.e. a 'D' practice in the classroom. It suggests that learners are instructed to do some work.
L1:85 Teacher	When you divide data into two parts then you get the median from there, take the first half, find the middle	**IL**	An indication of an interactive/authoritative presentation of the teacher (Scott et al., 2006), i.e. a 'D' practice in the classroom.

	quartile, find range, lower quartile, upper quartile,		It suggests that learners are instructed to do some work.
L1:90 Teacher	okay can you count your data here, in the stem 10, good, can you arrange stem and leaf in a correct way,	**IL**	An indication of an interactive/authoritative presentation of the teacher (Scott et al., 2006), i.e. a 'D' practice in the classroom. It suggests that learners are instructed to do some work.
L1:69 Teacher	Its true fifty? [in disbelief] can you put your hand on top of fifty, count this side then that side,	**IL**	An indication of an interactive/authoritative presentation of the teacher (Scott et al., 2006), i.e. a 'D' practice in the classroom. It suggests that learners are instructed to do some work.
L1:85 Teacher	When you divide data into two parts then you get the median from there, take the first half, find the middle quartile, find range, lower quartile, upper quartile,	**IL**	An indication of an interactive/authoritative presentation of the teacher (Scott et al., 2006), i.e. a 'D' practice in the classroom. It suggests that learners are instructed to do some work.
L2:23 Teacher	Remove the lower quartile, just do one thing at a time so that you are able to (...), good, eeh start with your median, remember we start with our median	**IL**	An indication of an interactive/authoritative presentation of the teacher (Scott et al., 2006), i.e. a 'D' practice in the classroom. It suggests that learners are instructed to do some work.
L2:57 Teacher	show, your five number summary then you say minimum value, lower quartile, medium, upper quartile and maximum value,	**IL**	An indication of an interactive/authoritative presentation of the teacher (Scott et al., 2006), i.e. a 'D' practice in the classroom. It suggests that learners are instructed to do some work.
L2:57 Teacher	right, so people try and draw it because most of you didn't draw it, okay I'm going to give you some five minutes to draw, but now people what we should do *ne* {ok} eeh try and use a scale,	**IL**	An indication of an interactive/authoritative presentation of the teacher (Scott et al., 2006), i.e. a 'D' practice in the classroom. It suggests that learners are instructed to do some work.
L2:59	Okay, so you can draw it using a free hand, sit down, it	**IL**	An indication of an interactive/authoritative presentation of the

Teacher	looks symmetrical but if, people you must use a ruler		teacher (Scott et al., 2006), i.e. a 'D' practice in the classroom. It suggests that learners are instructed to do some work.
L2:61 Teacher	So, let's use the ruler to draw a scale, okay draw,	**IL**	An indication of an interactive/authoritative presentation of the teacher (Scott et al., 2006), i.e. a 'D' practice in the classroom. It suggests that learners are instructed to do some work.
L2:73 Teacher	people you must draw those box and whiskers and then analyse the data, i.e. whether it is skewed or symmetrical, people	**IL**	An indication of an interactive/authoritative presentation of the teacher (Scott et al., 2006), i.e. a 'D' practice in the classroom. It suggests that learners are instructed to do some work.
L2:93 Teacher	Okay, try to find the median and then discuss it, check if it is correct	**IL**	An indication of an interactive/authoritative presentation of the teacher (Scott et al., 2006), i.e. a 'D' practice in the classroom. It suggests that learners are instructed to do some work.
L2:113 Teacher	go back and check the formula,	**IL**	An indication of an interactive/authoritative presentation of the teacher (Scott et al., 2006), i.e. a 'D' practice in the classroom. It suggests that learners are instructed to do some work.
L4:1 Teacher	I want you to continue answering those questions from the exam papers, and then each group will present a solution of a question to the class.	**IL**	An indication of an interactive/authoritative presentation of the teacher (Scott et al., 2006), i.e. a 'D' practice in the classroom. It suggests that learners are instructed to do some work.
L4:3 Teacher	Try to select a person who is going to present, not all questions, I'm going to give a chance to each group to give us a solution to a question, Try as many questions as you can present.	**IL**	An indication of an interactive/authoritative presentation of the teacher (Scott et al., 2006), i.e. a 'D' practice in the classroom. It suggests that learners are instructed to do some work.

P-R1	I first asked the learners to bring their last term's marks from 13 exercises be it a test, homework or class work so that we could work on the marks as our data	**IL**	An indication of an interactive/authoritative presentation of the teacher (Scott et al., 2006), i.e. a 'D' practice in the classroom. It suggests that learners are instructed to do some work.
P-R7	I ask them to read from the textbook and explain to the class their understanding of the terms…	**IL**	An indication of an interactive/authoritative presentation of the teacher (Scott et al., 2006), i.e. a 'D' practice in the classroom. It suggests that learners are instructed to do some work.

What this table illustrates is that:

- Learners are instructed on what to do. It implies that it is only the teacher who gives instruction as the data shows that no learner was observed giving instruction. This indicates teacher's interactive/authoritative presentation (Scott et al., 2006).
- Checking learners' work occurred in lessons 1 and 2 only implying that in these lessons learners wrote some work on definition of terms. The teacher used both ordinary and mathematical languages to instruct learners implying that the teacher inter-changes the languages when giving instruction in defining terms.

Speaker	**Utterance**	**Code**	**Comment**
L1:12 Teacher	Lower...	**INCS**	Leaving incomplete sentences is a way of talking the teacher allows (Gee, 2005); therefore, it is a 'D' practice she approves of because she allows learners to complete her incomplete sentence "Lower...."
L1:32 Teacher	Two outstanding values are...	**INCS**	Leaving incomplete sentences is a way of talking the teacher allows (Gee, 2005); therefore, it is a 'D' practice she approves of because she allows learners to complete her incomplete sentence.
L1:34 Teacher	they said find the range using the formula that the range is equal to	**INCS**	Leaving incomplete sentences is a way of talking the teacher allows (Gee, 2005); therefore, it is a 'D' practice she approves of because she allows learners to

	highest score minus...		complete her incomplete sentence.
L1:36 Teacher	find the range and the five number…	**INCS**	Leaving incomplete sentences is a way of talking the teacher allows (Gee, 2005); therefore, it is a 'D' practice she approves of because she allows learners to complete her incomplete sentence.
L1:40 Teacher	Arranging in...	**INCS**	Leaving incomplete sentences is a way of talking the teacher allows (Gee, 2005); therefore, it is a 'D' practice she approves of because she allows learners to complete her incomplete sentence.
L1:55 Teacher	Eighty two minus the lowest...	**INCS**	Leaving incomplete sentences is a way of talking the teacher allows (Gee, 2005); therefore, it is a 'D' practice she approves of because she allows learners to complete her incomplete sentence.
L1:81 Teacher	You understand now, you have to divide the data into...	**INCS**	Leaving incomplete sentences is a way of talking the teacher allows (Gee, 2005); therefore, it is a 'D' practice she approves of because she allows learners to complete her incomplete sentence.
L2:43 Teacher	And what is the inter quartile… [disagreeing with Brenda's answer]	**INCS**	Leaving incomplete sentences is a way of talking the teacher allows (Gee, 2005); therefore, it is a 'D' practice she approves of because she allows learners to complete her incomplete sentence.
L2:51 Teacher	okay Lerato wants to come and…	**INCS**	Leaving incomplete sentences is a way of talking the teacher allows (Gee, 2005); therefore, it is a 'D' practice she approves of because she allows learners to complete her incomplete sentence.
L2:55 Teacher	your five number…	**INCS**	Leaving incomplete sentences is a way of talking the teacher allows (Gee, 2005); therefore, it is a 'D' practice she approves of because she allows learners to

			complete her incomplete sentence.
L2:57 Teacher	is skewed to the left or skewed to the …	**INCS**	Leaving incomplete sentences is a way of talking the teacher allows (Gee, 2005); therefore, it is a 'D' practice she approves of because she allows learners to complete her incomplete sentence.
L2:59 Teacher	median and the ...	**INCS**	Leaving incomplete sentences is a way of talking the teacher allows (Gee, 2005); therefore, it is a 'D' practice she approves of because she allows learners to complete her incomplete sentence.
L2:65 Teacher	when is it skewed to the…	**INCS**	Leaving incomplete sentences is a way of talking the teacher allows (Gee, 2005); therefore, it is a 'D' practice she approves of because she allows learners to complete her incomplete sentence.
L2:69 Teacher	show the…	**INCS**	Leaving incomplete sentences is a way of talking the teacher allows (Gee, 2005); therefore, it is a 'D' practice she approves of because she allows learners to complete her incomplete sentence.
L2:71 Teacher	is it skewed to the…	**INCS**	Leaving incomplete sentences is a way of talking the teacher allows (Gee, 2005); therefore, it is a 'D' practice she approves of because she allows learners to complete her incomplete sentence.
L2:79 Teacher	already stem and leaf is giving you what, the…	**INCS**	Leaving incomplete sentences is a way of talking the teacher allows (Gee, 2005); therefore, it is a 'D' practice she approves of because she allows learners to complete her incomplete sentence.
L2:81 Teacher	The scores from the smallest to the…	**INCS**	Leaving incomplete sentences is a way of talking the teacher allows (Gee, 2005); therefore, it is a 'D' practice she approves of because she allows learners to

			complete her incomplete sentence.
L2:95 Teacher	It's what…	**INCS**	Leaving incomplete sentences is a way of talking the teacher allows (Gee, 2005); therefore, it is a 'D' practice she approves of because she allows learners to complete her incomplete sentence.
L2:107 Teacher	Thirty five and thirty seven divide by…	**INCS**	Leaving incomplete sentences is a way of talking the teacher allows (Gee, 2005); therefore, it is a 'D' practice she approves of because she allows learners to complete her incomplete sentence.
L2:109 Teacher	you write the two numbers and divide by...	**INCS**	Leaving incomplete sentences is a way of talking the teacher allows (Gee, 2005); therefore, it is a 'D' practice she approves of because she allows learners to complete her incomplete sentence.

What this table illustrates is that:

- The teacher leaves her statements uncompleted and the learners complete them. It implies teacher's way (Gee, 2005) of drawing learners' attention; therefore, she leaves incomplete sentences and allows learners to complete them.
- Incomplete sentences are already structured statements trying to funnel learners towards what is expected of them, therefore, the teacher was leading the learners in the explanation of definitions.
- Incomplete sentences occurred in lessons 1 and 2 only implying that in these lessons the teacher was practically teaching on the terms. The teacher used the mathematical language in her incomplete sentences which learners were meant to complete using the same language implying that the teacher uses and encourages the use of the mathematical language when defining terms.

Speaker	**Utterance**	**Code**	**Comment**
L2:2 Thabo	[Goes to the chalk board, draws a stem and leaf on the board, writes an incorrect spelling of the word 'stem' and the class	**LCB**	'D' - learner using the board, it shows that learners are allowed to write their ideas on the chalkboard, a

	corrects him],		classroom which is accepted by the teacher.
L2:51 Teacher	who wants to come and draw it, can we have someone who wants to come and draw a box and whiskers who wants to come and draw the box and whiskers,	**LCB**	'D' - learner using the board, it shows that learners are allowed to write their ideas on the chalkboard, a classroom which is accepted by the teacher.

What this table illustrates is that:

- Learners write their ideas on the chalkboard. This implies that sometimes the teacher allows learners to use and show their ideas on the chalkboard and this occurred in lesson 2 only implying that it does not occur frequently.

Speaker	**Utterance**	**Code**	**Comment**
P-R1	to assess where the learners are at first, what they already know about what I want to teach them…things like their prior knowledge,	**PK**	'D' – prior knowledge, a practice in the classroom. It suggests that learners' prior knowledge is assessed before new mathematical terms are taught to them.
P-R2	I used their knowledge of general average…because	**PK**	'D' – prior knowledge, a practice in the classroom. It suggests that learners' prior knowledge is assessed before new mathematical terms are taught to them.

What this table illustrates is that:

- The teacher sometimes uses learners' prior knowledge. This implies that learners' prior knowledge is important in the learning of new mathematical terms.

Speaker	Utterance	Code	Comment
L1:1 Teacher	I gave you some data to go and study, and you were working in groups so each group should tell us what they did, ok. What did you find from the work I gave you?	**RK**	Recapping previous work is a 'D' classroom practice which suggests that the teacher uses previously taught knowledge to introduce the lesson in defining the terms.
L2:1 Teacher	Which group can present the stem and leaf of the data from previous work,	**RK**	Recapping previous work is a 'D' classroom practice which suggests that the teacher uses previously taught knowledge to introduce the lesson in defining the terms.
P-R1	I recap what I had taught them to lead to what I want to teach…what I have noticed with my learners is that when	**RK**	Recapping previous work is a 'D' classroom practice which suggests that the teacher uses previously taught knowledge to introduce the lesson in defining the terms.

The table illustrates that:

- The teacher used previous work as a starting point in her 2 lessons (lesson 1 and 2). This implies that the teacher recaps information from previous work when introducing a lesson (L1:1 and L2:1). The teacher, in the interview, indicated that she uses previous knowledge to lead learners to current lessons (P-R1) and implied here is recapping previous knowledge on mathematical terms helps learners to access terminology.

Speaker	Utterance	Code	Comment
L1:49 Teacher	…right people can we just summarise here,	**SD**	Summing-up classroom deliberations are an indication of 'D', it suggests that the teacher is the leader and knows when to close up discussions. It also suggests that predetermined definitions are given by the teacher.
P-R7	I ask them to read from the textbook and explain to the class their understanding of the terms…then I finalise by explaining the term according to the textbook we are using in class.	**SD**	Summing-up classroom deliberations are an indication of 'D', it suggests that the teacher is the leader and knows when to close up discussions. It also suggests that predetermined definitions are given by the teacher because she indicates that she finalises by explaining the term according to the textbook.

The table illustrates that:

- The teacher summarises explanations. The data suggests that the teacher is the one who ends class conversations on terminology by summing up class ideas. She is the one who gives the final word (P-R7) on the definition of mathematical terms, which implies that the teacher leads the class to predetermined definition of terms.

Speaker	Utterance	Code	Comment
L1:34 Teacher	look at exercise eight point six on page one hundred eighty nine,	**TB**	This is indicative of 'D', i.e. textbook use. It suggests that the teacher uses a textbook in the explanation of the terms for she is asking learners to look at exercise eight point six on page one hundred eighty nine.
	the baker keeps (...) of number of dough nuts sold a day for three weeks, the numbers are (...) there is	**TB**	This is indicative of 'D', i.e. textbook use. It suggests that the teacher uses a textbook in the explanation of the terms because she is reading

	data that is listed there,		from the textbook.
L1:61 Teacher	They say arrange after that number b [looking into the textbook]	**TB**	This is indicative of 'D', i.e. textbook use. It suggests that the teacher uses a textbook in the explanation of the terms.
L2:33 Peter	then here you count again [counting again from one to eleven looking into the textbook] because your scores are given there	**TB**	This is indicative of 'D', i.e. textbook use. It suggests that the teacher uses a textbook in the explanation of the terms.
L2:73 Teacher	Right, people now let's move on to exercise eight coma ten, exercise eight coma ten, number one,	**TB**	This is indicative of 'D', i.e. textbook use. It suggests that the teacher uses a textbook in the explanation of the terms.
L2:79 Teacher	Eeh people exercise eight coma ten, *ne* {okay},	**TB**	This is indicative of 'D', i.e. textbook use. It suggests that the teacher uses a textbook in the explanation of the terms.
L2:89 Teacher	Where is your textbook, please bring the textbook to class all the time,	**TB**	This is indicative of 'D', i.e. textbook use. It suggests that the teacher uses a textbook in the explanation of the terms.
P-R4	to read around and from the textbook for them to understand better	**TB**	This is indicative of 'D' practice in the classroom. It suggests that learners are encouraged to read about terms from the textbook
P-R7	I ask them to read from the textbook and explain to the class their understanding of the terms…	**TB**	This is indicative of 'D' practice in the classroom. It suggests that learners are encouraged to read about terms from the textbook, because the teacher asks learners to read from their text books and explain to the class.

What this table illustrates is that:

- Learners are instructed to use and read from the textbook. It implies that the teacher uses the textbook when explaining the mathematical terms. Also implied is that the teacher leads the class to predetermined conventional definition of terms because the data shows that no other material was used to read from other than the textbook.

Speaker	**Utterance**	**Code**	**Comment**
L1:4 Class	No	**UR**	'D' – unison response, it suggests that this way of answering (Gee, 2005) is allowed by the teacher. The class is answering in unison and the teacher does not condemn the behaviour.
L1:6 Class	Highest score minus lowest score	**UR**	'D' – unison response, it suggests that this way of answering (Gee, 2005) is allowed by the teacher because the teacher does not criticise the behaviour.
L1:13 Class	Quartile	**UR**	'D' – unison response, it suggests that this way of answering (Gee, 2005) is allowed by the teacher learners answered chorally and were not condemned.
L1:15 Class	Q1	**UR**	'D' – unison response, it suggests that this way of answering (Gee, 2005) is allowed by the teacher
L1:17 Class	The median	**UR**	'D' – unison response, it suggests that this way of answering (Gee, 2005) is allowed by the teacher
L1:19 Class	Q2 or M	**UR**	'D' – unison response, it suggests that this way of answering (Gee, 2005) is allowed by the teacher
L1:21 Class	Yes	**UR**	'D' – unison response, it suggests that this way of answering (Gee, 2005) is allowed by the teacher

L1:25 Class	Upper quartile	**UR**	'D' – unison response, it suggests that this way of answering (Gee, 2005) is allowed by the teacher
L1:27 Class	Q3	**UR**	'D' – unison response, it suggests that this way of answering (Gee, 2005) is allowed by the teacher
L1:29 Class	Three	**UR**	'D' – unison response, it suggests that this way of answering (Gee, 2005) is allowed by the teacher
L1:31 Class	Five number summary	**UR**	'D' – unison response, it suggests that this way of answering (Gee, 2005) is allowed by the teacher
L1:33 Class	Minimum value and maximum value	**UR**	'D' – unison response, it suggests that this way of answering (Gee, 2005) is allowed by the teacher
L1:35 Class	Lowest score	**UR**	'D' – unison response, it suggests that this way of answering (Gee, 2005) is allowed by the teacher
L1:37 Class	Summary	**UR**	'D' – unison response, it suggests that this way of answering (Gee, 2005) is allowed by the teacher
L1:39 Many learners in one group	Arranging in...	**UR**	'D' – unison response, it suggests that this way of answering (Gee, 2005) is allowed by the teacher
L1:41 Many learners	In ascending order	**UR**	'D' – unison response, it suggests that this way of answering (Gee, 2005) is allowed by the teacher
L1:44 Class	Yes [nodding their heads in agreement]	**UR**	'D' – unison response, it suggests that this way of answering (Gee, 2005) is allowed by the teacher

L1:50 Class	Forty eight	**UR**	'D' – unison response, it suggests that this way of answering (Gee, 2005) is allowed by the teacher
L1:52 Class	No	**UR**	'D' – unison response, it suggests that this way of answering (Gee, 2005) is allowed by the teacher
L1:54 Class	Eighty two	**UR**	'D' – unison response, it suggests that this way of answering (Gee, 2005) is allowed by the teacher
L1:56 Class	Thirty four	**UR**	'D' – unison response, it suggests that this way of answering (Gee, 2005) is allowed by the teacher
L1:58 Class	Forty eight	**UR**	'D' – unison response, it suggests that this way of answering (Gee, 2005) is allowed by the teacher
L2:3 Class	*Kunye, kubili, kubili* {one, two two}	**UR**	'D' – unison response, it suggests that this way of answering (Gee, 2005) is allowed by the teacher
L2:6 Class	Fourteen, fifteen, sixteen, seventeen, eighteen	**UR**	'D' – unison response, it suggests that this way of answering (Gee, 2005) is allowed by the teacher
L2:9 Class	Twenty four	**UR**	'D' – unison response, it suggests that this way of answering (Gee, 2005) is allowed by the teacher
L2:15 Class	No it is five	**UR**	'D' – unison response, it suggests that this way of answering (Gee, 2005) is allowed by the teacher
L2:56 Class	Summary	**UR**	'D' – unison response, it suggests that this way of answering (Gee, 2005) is allowed by the teacher

L2:60 Class	Upper quartile	**UR**	‘D’ – unison response, it suggests that this way of answering (Gee, 2005) is allowed by the teacher
L2:70 Class	Maximum value	**UR**	‘D’ – unison response, it suggests that this way of answering (Gee, 2005) is allowed by the teacher
L2:72 Class	Left	**UR**	‘D’ – unison response, it suggests that this way of answering (Gee, 2005) is allowed by the teacher
L2:80 Class	The scores	**UR**	‘D’ – unison response, it suggests that this way of answering (Gee, 2005) is allowed by the teacher
L2:82 Class	Highest	**UR**	‘D’ – unison response, it suggests that this way of answering (Gee, 2005) is allowed by the teacher
L4:2 Class	Yes	**UR**	‘D’ – unison response, it suggests that this way of answering (Gee, 2005) is allowed by the teacher
L4:4 Class	Yes	**UR**	‘D’ – unison response, it suggests that this way of answering (Gee, 2005) is allowed by the teacher

What this table illustrates is that:

- Learners were answering in unison and the teacher did not condemn the behaviour. This implies that the teacher accepts unison responses in her class; it also implies a way of showing the togetherness of the class and that the class is a community of social morals (Gee, 2005) which promotes a good atmosphere in class as the terms are being explained. Also implied is that the teacher is leading the class to predetermined conventional definition of terms when she leaves incomplete sentences for learners to complete.
- Answering in unison occurred in all lessons and in this case, it is assumed the data shows that the behaviour is allowed.

Speaker	Utterance	Code	Comment
L1:22 Teacher	Which is the median, what is the median,	**VT**	This is indicative of 'D' practice in the classroom. It suggests that learners are involved in the definition of terms because the teacher asks a question intending to get a response from learners. Getting learners to define term as she verbalise the term.
P-R1	…what they think the mathematical term I want to teach mean after saying and	**VT**	Term verbalising is an indication of 'D' in the classroom, it suggests that the teacher tells learners terms and asks them questions as she promotes exchanges in defining the terms.

What this table illustrates is that:

- The teacher is asking learners "what is the median" which suggests that sometimes the teacher verbalises the term instead of writing it on the board. Also implied is that she uses question and answer in the explanation of terms.
- From the interview data (P-R1) the teacher indicated that she wants to understand what learners think about the mathematical term after saying it, this shows that the teacher verbalises the term to get learners' views.

Speaker	Utterance	Code	Comment
L1:5 Teacher	because that's what he has learned about [writes the term 'range' on the board],	**WTB**	'D' - chalkboard use, a classroom practice, which indicates that that the teacher writes the term on the board for learners to see and draw their attention to the term. A practice which suggests teacher's interactive/authoritative presentation of terms in class (Scott et al., 2006). The teacher was observed writing the term on the board.

P-R1	…what they think the mathematical term I want to teach mean after saying and writing the term on the board	**WTB**	'D' - chalkboard use, a classroom practice, which indicates that that the teacher writes the term on the board for learners to see and draw their attention to the term. A practice which suggests teacher's interactive/authoritative presentation of terms in class (Scott et al., 2006).
	I write a mathematical term on the board which is not familiar to them they keep quiet and I know they do not know this term then	**WTB**	'D' - chalkboard use, a classroom practice, which indicates that that the teacher writes the term on the board for learners to see and draw their attention to the term. A practice which suggests teacher's interactive/authoritative presentation of terms in class (Scott et al., 2006).
	if it needs a diagram for me to illustrate the term I draw it and	**WTB**	'D' - chalkboard use, a classroom practice, which indicates that that the teacher writes the term on the board for learners to see and draw their attention to the term. A practice which suggests teacher's interactive/authoritative presentation of terms in class (Scott et al., 2006).
	But sometimes when I write something on the board which they do have a clue about it,	**WTB**	'D' - chalkboard use, a classroom practice, which indicates that that the teacher writes the term on the board for learners to see and draw their attention to the term. A practice which suggests teacher's interactive/authoritative presentation of terms in class (Scott et al., 2006).
P-R2	when they show that what I have written on the board is known to them I assume it's informal or	**WTB**	'D' - chalkboard use, a classroom practice, which indicates that that the teacher writes the term on the board for learners to see and draw their attention to the term. A practice which suggests teacher's interactive/authoritative presentation of terms in class (Scott et al., 2006).
P-R7	But normally I write the	**WTB**	'D' - chalkboard use, a classroom practice, which indicates that that the teacher writes the term on the board for learners to see and draw their attention to the term. A practice which

	term on the board		suggests teacher's interactive/authoritative presentation of terms in class (Scott et al., 2006).

What this table illustrates is that:

- The teacher writes the term 'range' on the board which suggests that sometimes the teacher writes the mathematical terms on the board instead of verbalising it. Also implied is that the teacher uses the chalkboard in the explanation of terms.
- From the interview data (P-R1, 2 and 7), it shows that the teacher normally writes the new term on the board (P-R7) and this implies that most of the time when introducing a term for the first time in class the teacher writes it on the board for learners to see because learners learn effectively by seeing (Graber, 1990).
- In (P-R1) the teacher indicated that she wants to understand what learners think about the mathematical term after saying and writing the term on the board, this implies that the teacher alternates these two ways of presenting the terms to the learners.

Speaker	**Utterance**	**Code**	**Comment**
L2:99 Teacher	Sixteen, okay and thirty five, (-) okay let us see, you say half is sixteen, sixteen it means the first sixteen and the last sixteen, so let us talk about thirty two, thirty two, is it an even number or an odd number	**BR**	Building on learners' responses is part of the 'D'; it suggests that the teacher uses learners' responses to prod further ideas in defining terms.
L2:101 Teacher	So if it is an even number what do we do	**BR**	Building on learners' responses is part of the 'D', it suggests that the teacher uses learners' responses to prod further ideas in defining terms.
P-R7	I might use the responses to ask more questions as a follow-up…	**BR**	Building on learners' responses is part of the 'D', it suggests that the teacher uses learners' responses to prod further ideas in defining terms as the teacher indicates that she may use learners' responses to ask further questions.

What this table illustrates is that:

- Learners' contributions are being used to solicit more information about the term in question. This implies that the teacher sometimes builds on learners' responses in order to get to the term's definition.
- The two utterances (L2:99 and 101) show that a learner had given the answer sixteen and even number respectively and the teacher builds on the responses. Also the teacher in interview data (P-R7) indicated that she may use learners' responses to ask further questions. This implies that the building on learner responses is not obvious but she sometimes uses them in the explanation of the mathematical terms.

Speaker	**Utterance**	**Code**	**Comment**
L1:7 Teacher	Ok, I will separate whatever you give me, tell me whether it falls under the five number summary	**CI**	Is a 'D' practice which suggests that the teacher considers learners' ideas and contributions in the definition of terms because the teacher suggests to separate learners' ideas than ignoring them.

What this table illustrates is that:

- The teacher tells the learners that she will separate the ideas the learners are giving, this suggests that the teacher considers learners' ideas and contributions in the definition of terms. Also implied is that there are interactions taking place in the class.

Speaker	**Utterance**	**Code**	**Comment**
L1:10 Teacher	[with a surprised face]	**E**	A facial expression, Grammar 2, was used to accompany verbal communication (Gee, 2005), therefore, it is a 'D' practice. It suggests that the teacher approves of non-verbal communication in the explanation of the terms.

L1:30 Teacher	[facial expressions and	**E**	A facial expression, Grammar 2, was used to accompany verbal communication (Gee, 2005), therefore, it is a 'D' practice. It suggests that the teacher approves of non-verbal communication in the explanation of the terms.
L1:43 Teacher	[opening the hands with a sharp facial expression in surprise]	**E**	A facial expression, Grammar 2, was used to accompany verbal communication (Gee, 2005), therefore, it is a 'D' practice. It suggests that the teacher approves of non-verbal communication in the explanation of the terms.
P-R1	…when I write something on the board which they do have a clue about it, its normally shown by their facial expression…eh… I just switch to questions of wanting to know what they know about that	**E**	A facial expression, Grammar 2, is used to communicate (Gee, 2005), therefore, it is a 'D' practice. It suggests that the teacher approves of non-verbal communication in the explanation of the terms

What this table illustrates is that:

- From the data, the teacher was using facial expressions as body language to accompany verbal utterances. This implies that the teacher uses Grammar 2 to accompany verbal communication (Gee, 2005) in the explanation of mathematical terms. Also implied is that facial expressions are a form of communication the teacher approves in this class, she indicated this in the interview (P-R1) where she said learners normally show by facial expression if they do not know the term which then forces her to switch to questions seeking their prior knowledge. This suggests the teacher uses prior knowledge to get learners access terminology.

Speaker	**Utterance**	**Code**	**Comment**
L1:22 Teacher	[looking for a volunteer and pointing to a learner] let's go back a little bit	**G**	'D' – Grammar 2 (Gee, 2005), in that the teacher uses gestures to accompany verbal communication. It suggests that the teacher practices a non-verbal communication in the explanation of the terms, here the teacher was observed

			looking around and pointing to a learner who then gave descriptive explanation of the term. She points at learners at random (in no particular order).
L1:28 Teacher	[pointing to the work on the board]	**G**	'D' – Grammar 2 (Gee, 2005), in that the teacher uses gestures to accompany verbal communication. It suggests that the teacher approves of non-verbal communication in the explanation of the terms.
L1:30 Teacher	[pointing to Q1, M, and Q2]	**G**	'D' – Grammar 2 (Gee, 2005), in that the teacher uses gestures to accompany verbal communication. It suggests that the teacher approves of non-verbal communication in the explanation of the terms. Assisting learners to provide a correct answer
	hands movements indicating that all what was explained was heading to an important key term or phrase]	**G**	'D' – Grammar 2 (Gee, 2005), in that the teacher uses gestures to accompany verbal communication. It suggests that the teacher approves of non-verbal communication in the explanation of the terms.
L1:43 Teacher	[opening the hands with a sharp facial expression in surprise]	**G**	'D' – Grammar 2 (Gee, 2005), in that the teacher uses gestures to accompany verbal communication. It suggests that the teacher approves of non-verbal communication in the explanation of the terms.
L1:57 Teacher	Which is [pointing at the data set on the board]	**G**	'D' – Grammar 2 (Gee, 2005), in that the teacher uses gestures to accompany verbal communication. It suggests that the teacher approves of non-verbal communication in the explanation of the terms.
L1:71 Teacher	No [shaking the head], she got seventy six, she has sixty nine we don't have sixty nine,	**G**	'D' – Grammar 2 (Gee, 2005), in that the teacher uses gestures to accompany verbal communication. It suggests that the teacher approves of non-verbal communication in the explanation of the terms.

L2:21 Teacher	[with an encouragement hand gesture for the learner to continue]	**G**	'D' – Grammar 2 (Gee, 2005), in that the teacher uses gestures to accompany verbal communication. It suggests that the teacher approves of non-verbal communication in the explanation of the terms.
L2:30 Joy	I jumped this number, then I got to [points at 3 in between 33 and 34 in row three]	**G**	'D' – Grammar 2 (Gee, 2005), in that the teacher uses gestures to accompany verbal communication. It suggests that the teacher approves of non-verbal communication in the explanation of the terms.
L2:31 Peter	No, no [with flying hands and head shaking in disagreement]	**G**	'D' – Grammar 2 (Gee, 2005), in that the teacher uses gestures to accompany verbal communication. It suggests that the teacher approves of non-verbal communication in the explanation of the terms.
L2:32 Teacher	[pointing at Peter giving him a chance to bring his idea]	**G**	'D' – Grammar 2 (Gee, 2005), in that the teacher uses gestures to accompany verbal communication. It suggests that the teacher approves of non-verbal communication in the explanation of the terms.
L2:37 Joy	Upper quartile, for the upper quartile, I'm going to take the second half [pointing at the data set on the board]	**G**	'D' – Grammar 2 (Gee, 2005), in that the teacher uses gestures to accompany verbal communication. It suggests that the teacher approves of non-verbal communication in the explanation of the terms.
L2:45 Teacher	Range [nodding her head]	**G**	'D' – Grammar 2 (Gee, 2005), in that the teacher uses gestures to accompany verbal communication. It suggests that the teacher approves of non-verbal communication in the explanation of the terms.
L2:47 Teacher	What was there [pointing at the data on the board], are you listening	**G**	'D' – Grammar 2 (Gee, 2005), in that the teacher uses gestures to accompany verbal communication. It suggests that the teacher approves of non-verbal communication in the explanation of the terms.

L2:61 Teacher	did you see what I did there? [pointing to the board]	**G**	'D' – Grammar 2 (Gee, 2005), in that the teacher uses gestures to accompany verbal communication. It suggests that the teacher approves of non-verbal communication in the explanation of the terms.
L2:103 Teacher	is it what you did [with a frontical gesture]	**G**	'D' – Grammar 2 (Gee, 2005), in that the teacher uses gestures to accompany verbal communication. It suggests that the teacher approves of non-verbal communication in the explanation of the terms.
L2:119 Teacher	[shaking her head disagreeing with the learner]	**G**	'D' – Grammar 2 (Gee, 2005), in that the teacher uses gestures to accompany verbal communication. It suggests that the teacher approves of non-verbal communication in the explanation of the terms.
L2:121 Teacher	[hands gestures wanting to know how the mean is calculated]	**G**	'D' – Grammar 2 (Gee, 2005), in that the teacher uses gestures to accompany verbal communication. It suggests that the teacher approves of non-verbal communication in the explanation of the terms
L2:123 Teacher	[pointing to the formula written on the board]	**G**	'D' – Grammar 2 (Gee, 2005), in that the teacher uses gestures to accompany verbal communication. It suggests that the teacher approves of non-verbal communication in the explanation of the terms.

What this table illustrates is that:

- The class used gestures as body language to accompany verbal utterances. The data shows that gestures were used more by the teacher than by the learners; this implies that the teacher uses Grammar 2 to accompany verbal communication (Gee, 2005) in the explanation of mathematical terms. Also implied is that gestures are a form of communication the teacher approves in this class as the data shows that even learners were using gestures to communicate with the teacher (lines L2:30, L2:31 and L2:37) where Joy and Peter used hand gestures as they were talking to the teacher. The teacher did not reprimand the learners; therefore, Grammar 2 is used in the Discourse.

Speaker	Utterance	Code	Comment
L1:71 Teacher	you are not working in a group, you must discuss as a group, you see,	**GD**	'D' – group work, it suggests teacher's teaching strategy which creates and engages learners in sound CIT1 pattern of interaction when teaching mathematical terms (Scott et al., 2006)
L1:75 Teacher	or we want sixty seven and sixty two, right let's discuss in groups, two minutes	**GD**	'D' – group work, it suggests teacher's teaching strategy which creates and engages learners in sound CIT1 pattern of interaction when teaching mathematical terms (Scott et al., 2006)
L1:77 Teacher	are you working as a group, you must work as a group, so discuss,	**GD**	'D' – group work, it suggests teacher's teaching strategy which creates and engages learners in sound CIT1 pattern of interaction when teaching mathematical terms (Scott et al., 2006)
L1:92 Teacher	And then first quartile, *le* {this one} right do the discussions, eeh Brenda you must remind your group mates,	**GD**	'D' – group work, it suggests teacher's teaching strategy which creates and engages learners in sound CIT1 pattern of interaction when teaching mathematical terms (Scott et al., 2006)
L2:93 Teacher	Okay, try to find the median and then discuss it, check if it is correct	**GD**	'D' – group work, it suggests teacher's teaching strategy which creates and engages learners in sound CIT1 pattern of interaction when teaching mathematical terms (Scott et al., 2006)

L4:1 Teacher	Stop concentrating on your book, we all have eeh question papers, this is one of the typical exam questions, I want you to answer them after you have discussed with people in your group, I will be back after twenty five minutes, okay	**GD**	'D' – group work, it suggests teacher's teaching strategy which creates and engages learners in sound CIT1 pattern of interaction when teaching mathematical terms (Scott et al., 2006)
L4:3 Teacher	Are you discussing with your group? [leaving the class for a meeting]	**GD**	'D' – group work, it suggests teacher's teaching strategy which creates and engages learners in sound CIT1 pattern of interaction when teaching mathematical terms (Scott et al., 2006)
P-R7	because even if I would have explained the definition… learners need to discuss on their own and with this they share their understandings and they do that using their languages and it helps those who would have missed during my teaching.	**GD**	Group discussion an indication of 'D' in the class room. It indicates that learners are allowed to discuss the meanings of terms in their groups.

What this table illustrates is:

- The teacher's emphasis on learners working in groups. As is her sitting and teaching strategy, she needs to emphasise on group discussions. This implies that the teacher uses group discussions in the explanation of mathematical terms with an understanding that group discussion might promote the understanding (Holyes, 1985) of mathematical terminology in learners. The teacher seemed to indicate this in the interview (see P-R7). Also implied is that learners are allowed to use their non-mathematical languages (NML) in the discussions to activate understanding and the teacher seem not to have a problem with it (P-R7).
- Emphasis on working in groups occurred in all the lessons and was mentioned in the interview as is indicated in the data. This implies that the teacher's teaching strategy is group work.
- The teacher used both ordinary and mathematical languages to emphasise on group work and this suggests the inter-change of these languages by the teacher with the intention to cater for multilingualism in class.

Speaker	Utterance	Code	Comment
L1:51 Teacher	people did we arrange from the highest to the lowest, yes or no	**HC**	Giving hints or clues is a 'D' practice which suggests that the teacher uses hints and clues to aid learners in the explanation of terms.
L1:53 Teacher	because you will be wasting your time, look (...) find the highest score, find the lowest score and (...) move on, now number 2,	**HC**	Giving hints or clues is a 'D' practice which suggests that the teacher uses hints and clues to aid learners in the explanation of terms by asking them to find the highest and the lowest scores form the data.
L1:67 Teacher	did you arrange in ascending order, so which one is your median then, okay lets count, count the data, count your scores there,	**HC**	Giving hints or clues is a 'D' practice which suggests that the teacher uses hints and clues to aid learners in the procedural explanation of terms.
L1:69 Teacher	Its true fifty? [in disbelief] can you put your hand on top of fifty, count this side then that side,	**HC**	Giving hints or clues is a 'D' practice which suggests that the teacher uses hints and clues to aid learners in the procedural explanation of the term
L2:57 Teacher	I will be coming to you and show you how to use a scale so that you can actually see whether your box and whiskers is symmetrical,	**HC**	Giving hints or clues is a 'D' practice which suggests that the teacher uses hints and clues to aid learners in the explanation of terms.
L2:83 Teacher	your data already has been arranged in an ascending order okay,	**HC**	Giving hints or clues is a 'D' practice which suggests that the teacher uses hints and clues to aid learners in the explanation of terms.

What this table illustrates is that:

- The teacher gives learners some clues to help them define terms. This suggests that the teacher uses hints and clues to assist learners in the explanation of terms. Also implied is that the teacher leads the class to predetermined conventional definition of terms because the hints and clues she gives are actually funnelling learners towards what they are expected to learn. For example, in L1:51 and L1:69 the hint is funnelling learners to getting the predetermined value for the 'range' and for the 'median' respectively.

- The teacher was using mathematical language which suggests that she uses this language always in class.
- Giving hints and clues occurred in lessons 1 and 2 only implying that hints and clues are given when terms are being explained because explanation of terms took place in those lessons other than in lesson 4.

Speaker	**Utterance**	**Code**	**Comment**
L1:67 Teacher	how many scores do you have one two three four five [counting the scores together with the learner] seven so which one is in the middle	**LQ**	This is indicative of 'D', i.e. some practice in the classroom. It suggests that learners are asked leading questions which can help them define terms.
L1:69 Teacher	so let's just count seventy eight sixty seven which one is the middle number,	**LQ**	This is indicative of 'D', i.e. some practice in the classroom. It suggests that learners are asked leading questions which can help them define terms.

What this table illustrates is that:

- The teacher is asking some questions and these are leading questions. This implies that the teacher sometimes uses leading questions to prod learners' ideas about the mathematical terms.

Speaker	**Utterance**	**Code**	**Comment**
L1:24 Teacher	Right, it is the middle value of that data when the data is arranged in order of size, right[paraphrasing learner's utterance]	**PP**	Paraphrasing learner's answer (Pressley et al, 1989) is an indication of a 'D' practice, here the teacher paraphrases learner's textbook descriptive definition of the term 'median' towards a predetermined definition.
L2:103	*Ja* {yes} we must take score number sixteen plus score number seventeen add them together and	**PP**	Paraphrasing learner's answer (Pressley et al, 1989) is an indication of a 'D' practice, here the teacher paraphrases learner's textbook

Teacher	divide by two, is it what you did,		descriptive definition of the term ‘median’

What this table illustrates is that:

- The teacher is paraphrasing learner’s answer. This implies that the teacher sometimes paraphrases learners’ ideas about the mathematical terms for others to hear and understand the contribution clearly (Pressley et al, 1989).
- Paraphrasing learner’s answer shows teacher’s feelings and the importance attached to the definition of the term. It also implies that the teacher exhibits good listening skills which are necessary in fostering fruitful interactions in class (Davis, 1997).

Speaker	**Utterance**	**Code**	**Comment**
L1:1 Teacher	What did you find from the work I gave you?	**QR**	This is indicative of ‘D’ practice in the classroom. It suggests that learners are involved in the definition of terms because the teacher asks a question intending to get a response from learners and a learner responded.
L1:3 Teacher	is the range part of the five number summary, yes, no	**QR**	This is indicative of ‘D’ practice in the classroom. It suggests that learners are involved in the definition of terms because the teacher asks a question intending to get a response from learners. The teacher is coercing a ‘chorus answer’
L1:5 Teacher	saying the range, how do you define the range, what is the range	**QR**	This is indicative of ‘D’ practice in the classroom. It suggests that learners are involved in the definition of terms because the teacher asks the question “how do you define the range” intending to get a response from learners.
L1:14 Teacher	What's the abbreviation of the lower quartile	**QR**	This is indicative of ‘D’ practice in the classroom. It suggests that learners are involved in the definition of terms because the teacher asks a question intending to get a response from learners. Also suggests teaching of conventional abbreviations
L1:16	and the other one?	**QR**	This is indicative of ‘D’ practice in the classroom. It suggests that learners are involved in the definition of terms because the teacher asks a question intending to

Teacher			get a response from learners. This a prompt is to ensure that all expected answers are provided
L1:22 Teacher	Which is the median, what is the median,	**QR**	This is indicative of 'D' practice in the classroom. It suggests that learners are involved in the definition of terms because the teacher asks a question intending to get a response from learners. Getting learners to define term as she verbalise the term.
L1:24 Teacher	Next what is the third quartile	**QR**	This is indicative of 'D' practice in the classroom. It suggests that learners are involved in the definition of terms because the teacher's question intends learners to response.
L1:26 Teacher	how do we abbreviate	**QR**	This is indicative of 'D' practice in the classroom. It suggests that learners are involved in the definition of terms because the teacher asks a question intending to get a response from learners. Thus teaching of abbreviations.
L1:28 Teacher	how many do we have now	**QR**	This is indicative of 'D' practice in the classroom. It suggests that learners are involved in the definition of terms because the teacher asks a question intending to get a response from learners. Inviting learners to count the number of terms used so far.
L1:30 Teacher	but what are we looking for	**QR**	This is indicative of 'D' practice in the classroom. It suggests that learners are involved in the definition of terms because the teacher asks a question intending to get a response from learners. The teacher is probing
L1:38 Teacher	okay, what is the first step, what do you do	**QR**	This is indicative of 'D' practice in the classroom. It suggests that learners are involved in the definition of terms because the teacher asks a question intending to

			get a response from learners.
L1:43 Teacher	Who (...) okay what is the range, can you define range, if not yet understood	**QR**	This is indicative of 'D' practice in the classroom. It suggests that learners are involved in the definition of terms because the teacher asks a question intending to get a response from learners. Seeking definition from learners.
L1:47 Teacher	do you get range here,	**QR**	This is indicative of 'D' practice in the classroom. It suggests that learners are involved in the definition of terms because the teacher asks a question intending to get a response from learners.
L1:49 Teacher	what is your range here,	**QR**	This is indicative of 'D' practice in the classroom. It suggests that learners are involved in the definition of terms because the teacher asks a question intending to get a response from learners.
	what is the range	**QR**	This is indicative of 'D' practice in the classroom. It suggests that learners are involved in the definition of terms because the teacher asks a question intending to get a response from learners.
L1:53 Teacher	we have the range there, what is the highest score there	**QR**	This is indicative of 'D' practice in the classroom. It suggests that learners are involved in the definition of terms because the teacher asks a question intending to get a response from learners.
L1:63 Teacher	The median number is the middle number which one is the middle number	**QR**	This is indicative of 'D' practice in the classroom. It suggests that learners are involved in the definition of terms because the teacher asks a question intending to get a response from learners.
L1:67 Teacher	Which one is in the middle, okay let's check	**QR**	This is indicative of 'D' practice in the classroom. It suggests that learners are involved in the definition of terms because the teacher asks a question intending to

			get a response from learners.
L1:71 Teacher	how did you define the median,	**QR**	This is indicative of 'D' practice in the classroom. It suggests that learners are involved in the definition of terms because the teacher asks a question intending to get a response from learners.
	what does middle mean	**QR**	This is indicative of 'D' practice in the classroom. It suggests that learners are involved in the definition of terms because the teacher asks a question intending to get a response from learners.
L1:73 Teacher	you said your median is what?	**QR**	This is indicative of 'D' practice in the classroom. It suggests that learners are involved in the definition of terms because the teacher asks a question intending to get a response from learners.
L1:75 Teacher	what is the median and give me your answer (...) not at all	**QR**	This is indicative of 'D' practice in the classroom. It suggests that learners are involved in the definition of terms because the teacher asks a question intending to get a response from learners.
	Q1 what is Q1, the first quartile and the minimum value, are they the same	**QR**	This is indicative of 'D' practice in the classroom. It suggests that learners are involved in the definition of terms because the teacher asks a question intending to get a response from learners.
L1:77 Teacher	what is the difference between first quartile and minimum value, third quartile and maximum value,	**QR**	This is indicative of 'D' practice in the classroom. It suggests that learners are involved in the definition of terms because the teacher asks a question intending to get a response from learners.
L1:88 Teacher	what is the median?	**QR**	This is indicative of 'D' practice in the classroom. It suggests that learners are involved in the definition of terms because the teacher asks a question intending to

			get a response from learners.
L1:98 Teacher	When did you do it (...) with stem and leaf	**QR**	This is indicative of ‘D’ practice in the classroom. It suggests that learners are involved in the definition of terms because the teacher asks a question intending to get a response from learners.
L2:8 Teacher	How many scores are there?	**QR**	This is indicative of ‘D’ practice in the classroom. It suggests that learners are involved in the definition of terms because the teacher asks a question intending to get a response from learners.
L2:19 Teacher	what did you write, what is your lower quartile,	**QR**	This is indicative of ‘D’ practice in the classroom. It suggests that learners are involved in the definition of terms because the teacher asks a question intending to get a response from learners
	how do you find the lower quartile	**QR**	This is indicative of ‘D’ practice in the classroom. It suggests that learners are involved in the definition of terms because the teacher asks a question intending to get a response from learners.
L2:29 Teacher	How do you find the lower quartile tell us	**QR**	This is indicative of ‘D’ practice in the classroom. It suggests that learners are involved in the definition of terms because the teacher asks a question intending to get a response from learners.
L2:41 Teacher	Brenda what is the range?	**QR**	This is indicative of ‘D’ practice in the classroom. It suggests that learners are involved in the definition of terms because the teacher asks a question intending to get a response from learners.
L2:43 Teacher	And what is the inter quartile… [disagreeing with Brenda’s answer]	**QR**	This is indicative of ‘D’ practice in the classroom. It suggests that learners are involved in the definition of terms because the teacher asks a question intending to

			get a response from learners.
L2:89 Teacher	how many did you get	**QR**	This is indicative of 'D' practice in the classroom. It suggests that learners are involved in the definition of terms because the teacher asks a question intending to get a response from learners
L2:91 Teacher	*Ja* {yes} have you found the median	**QR**	This is indicative of 'D' practice in the classroom. It suggests that learners are involved in the definition of terms because the teacher asks a question intending to get a response from learners.
L2:99 Teacher	sixteen it means the first sixteen and the last sixteen, so let us talk about thirty two, thirty two, is it an even number or an odd number	**QR**	This is indicative of 'D' practice in the classroom. It suggests that learners are involved in the definition of terms because the teacher asks a question intending to get a response from learners. Teacher asks leading question
L2:105 Teacher	So which one is it	**QR**	This is indicative of 'D' practice in the classroom. It suggests that learners are involved in the definition of terms because the teacher asks a question intending to get a response from learners.
L2:113 Teacher	now what's the formula for the mean,	**QR**	This is indicative of 'D' practice in the classroom. It suggests that learners are involved in the definition of terms because the teacher asks a question intending to get a response from learners. It also suggests that a formula is used to deliver the meaning of the term.
	how did you write the formula, how do we write our formula	**QR**	This is indicative of 'D' practice in the classroom. It suggests that learners are involved in the definition of terms because the teacher asks a question intending to get a response from learners.

L2:119 Teacher	is it correct	**QR**	This is indicative of 'D' practice in the classroom. It suggests that learners are involved in the definition of terms because the teacher asks a question intending to get a response from learners.
L2:121 Teacher	so how must you calculate the mean	**QR**	This is indicative of 'D' practice in the classroom. It suggests that learners are involved in the definition of terms because the teacher asks a question intending to get a response from learners.
L2:119 Teacher	is it correct	**QR**	This is indicative of 'D' practice in the classroom. It suggests that learners are involved in the definition of terms because the teacher asks a question intending to get a response from learners.
P-R1	I just switch to questions of wanting to know what they know about that.	**QR**	This is indicative of 'D' practice in the classroom. It suggests that learners are involved in the definition of terms because the teacher asks a question intending to get a response from learners
P-R2	I will ask them some questions	**QR**	Question and response, this is indicative of 'D' practice in the classroom. It suggests that learners are involved in the definition of terms because the teacher asks a question intending to get a response from learners.
P-R7	and ask questions, and when they give some responses	**QR**	This is indicative of 'D' practice in the classroom. It suggests that learners are involved in the definition of terms because the teacher asks a question intending to get a response from learners.

What this table illustrates is that:

- The teacher was asking learners questions which called for response. This implies that the teacher meant to involve learners in the explanation of terms by asking questions intending to get responses.

- This type of questioning occurred in lessons 1 and 2 only implying that it is where terms were being explained, and the frequency of questioning in both the lessons seems to be high and balancing implying that the teacher mostly uses question and response as a way to involve learners/groups in the interaction. Also depicted is a highly interactive class.
- Question and response did not occur in lesson 4 because there was no explanation of terms taking place.
- The teacher used both ordinary and mathematical languages in the question and response and this suggests the inter-change of these languages by the teacher with the intention to cater for multilingualism in class.

Speaker	**Utterance**	**Code**	**Comment**
L1:3 Teacher	Ooh he is saying the range, what he has found out is that there is a range there. So range is there, is the range part of the five number summary,	**RFQ**	A ‘D’ in that the teacher uses learners’ responses to ask further questions and it suggests teacher’s level of response the IR2/3, prodding learners towards a predetermined definition of the term. The teacher used range (learner’s answer) to ask if it is part of number summary.
L1:18 Teacher	right median, the abbreviation	**RFQ**	A ‘D’ in that the teacher uses learners’ responses to ask further questions and it suggests teacher’s level of response the IR2/3, prodding learners towards a predetermined definition of the term. The teacher used the answer “median” to ask for its abbreviation. The abbreviation is part of the topic’s discourse.
L1:71 Teacher	you say the median is the middle number, what does middle mean	**RFQ**	Also a ‘D’ in that the teacher uses learners’ responses to ask further questions and it suggests teacher’s level of response the IR2, prodding learners towards a predetermined definition of the term.
L1:73 Teacher	In between what,	**RFQ**	A ‘D’ in that the teacher uses learners’ responses to ask further questions and it suggests teacher’s level of response the IR2/3, prodding learners towards a predetermined definition of the term.
L2:51	Okay who can draw that box and whiskers for us on the board so that	**RFQ**	A ‘D’ in that the teacher uses learners’ responses to ask further questions and it suggests teacher’s level of response the IR2, prodding learners towards a

Teacher	we can move on		predetermined definition of the term.
P-R7	I might use the responses to ask more questions as a follow-up…	**RFQ**	A 'D' in that the teacher uses learners' responses to ask further questions and it suggests teacher's level of response the IR2/3, prodding learners towards a predetermined definition of the term.

What this table illustrates is:

- The use of learners' responses in teacher's questions. After learners have given responses the teacher would use some to ask questions, this implies that the teacher uses learners' responses to ask further questions. Also implied from the data (see transcripts) is that the teacher prods more information on mathematical terms from learners by using their responses to ask further/leading questions.
- From the interview data (P-R7) the teacher indicated that she uses learners' responses to ask more questions as a follow-up, implying that she evaluates learners understanding of terminology through these further questions.
- The teacher used both ordinary and mathematical languages in the question and response and this suggests the inter-change of these languages by the teacher with the intention to cater for multilingualism in class.

Speaker	**Utterance**	**Code**	**Comment**
L1:71 Teacher	you say the median is the middle number, what does middle mean	**R**	A 'D' practice in the classroom which suggests that the teacher at times revisits ideas.

What this table illustrates is:

- Teacher's statement of revisiting learner's idea. This implies that the teacher sometimes revisits learners' ideas about term and uses it to ask further questions.
- Revisiting ideas shows teacher's feelings and the importance attached to the definition of the term. It also implies that the teacher exhibits good listening skills which are necessary in fostering fruitful interactions in class (Davis, 1997).

Speaker	Utterance	Code	Comment
L1:20 Teacher	Q2 or M, This one [pointing at M on the board]	**RCW**	Referring to chalkboard work is indicative of a 'D' practice. It suggests that the teacher values chalkboard work as she was seen pointing to the work at the board in her explanation of the terms.
L1:49 Teacher	[going back to the board]	**RCW**	Referring to chalkboard work is an indicative of a 'D' practice. It suggests that the teacher values chalkboard work as she was seen pointing to the work at the board in her explanation of the terms.
L2:40 Joe	because it is the highest number that is given here [pointing at the board]	**RCW**	Referring to chalkboard work is an indicative of a 'D' practice. It suggests that the teacher values chalkboard work as she does not condemn Joy who was pointing to the work at the board in her explanation of the terms.
L2:47 Teacher	What was there [pointing at the data on the board], are you listening	**RCW**	Referring to chalkboard work is an indicative of a 'D' practice. It suggests that the teacher values chalkboard work as she was seen pointing to the work at the board in her explanation of the terms.
L2:61 Teacher	did you see what I did there? [pointing to the board]	**RCW**	Referring to chalkboard work is an indicative of a 'D' practice. It suggests that the teacher values chalkboard work as she was seen pointing to the work at the board in her explanation of the terms.
L2:69 Teacher	*Ja* {yes}, but then you must show the numbers, you know why you must show the numbers [referring to the box and whiskers on the board], because when I'm marking your papers	**RCW**	Referring to chalkboard work is an indicative of a 'D' practice. It suggests that the teacher values chalkboard work as she was seen pointing to the work at the board in her explanation of the terms.
L2:123	[pointing to the formula written on the board]	**RCW**	Referring to chalkboard work is an indicative of a 'D' practice. It suggests

Teacher			that the teacher values chalkboard work as she was seen pointing to the work at the board in her explanation of the terms.

What this table illustrates are:

- Some gestures of pointing to chalkboard work. This implies that the teacher uses chalkboard work as references, therefore, she writes or allows learners to write important work about the term in question on the board so that they can use it as reference. Also implied is the use of the chalkboard by the class in the explanation of mathematical terms.

Speaker	**Utterance**	**Code**	**Comment**
L1:3 Teacher	Ooh he is saying the range,	**RV**	'D' - which suggests teacher re-voices learners' answers (Enyedy et al., 2008) in the process of defining terms, the teacher tells the class that the learner was saying range i.e. re-voicing, and that teacher re-voices for the whole class to hear what the learner had said. It could be that the learner was also speaking softly.
L1:18 Teacher	The median	**RV**	'D' - which suggests teacher re-voices learners' answers (Enyedy et al., 2008) in the process of defining terms, the teacher re-uttered "the median" after the class had said it.
L1:26 Teacher	Upper quartile	**RV**	'D' - which suggests teacher re-voices learners' answers (Enyedy et al., 2008) in the process of defining terms
L1:28 Teacher	Q3	**RV**	'D' - which suggests teacher re-voices learners' answers (Enyedy et al., 2008) in the process of defining terms
L1:30 Teacher	One, two, three,	**RV**	'D' - which suggests teacher re-voices learners' answers (Enyedy et al., 2008) in the process of defining terms The teacher is asking for a definite answer and at the

			same time encouraging a chorus answer.
L1:34 Teacher	It is the minimum value and maximum value,	**RV**	'D' - which suggests teacher re-voices learners' answers (Enyedy et al., 2008) in the process of defining terms
L1:38 Teacher	Five number summary	**RV**	'D' - which suggests teacher re-voices learners' answers (Enyedy et al., 2008) in the process of defining terms
L1:51 Teacher	Forty eight	**RV**	'D' - which suggests teacher re-voices learners' answers (Enyedy et al., 2008) in the process of defining terms
L1:53 Teacher	No	**RV**	'D' - which suggests teacher re-voices learners' answers (Enyedy et al., 2008) in the process of defining terms
L1:59 Teacher	Forty eight	**RV**	'D' - which suggests teacher re-voices learners' answers (Enyedy et al., 2008) in the process of defining terms
L1:65 Teacher	Between sixty seven and sixty two (-) you say the median is between sixty seven and sixty two	**RV**	'D' - which suggests teacher re-voices learners' answers (Enyedy et al., 2008) in the process of defining terms
L2:27 Teacher	Twenty three {re-voicing learner's utterance}	**RV**	'D' - which suggests teacher re-voices learners' answers (Enyedy et al., 2008) in the process of defining terms
L2:45 Teacher	Range	**RV**	'D' - which suggests teacher re-voices learners' answers (Enyedy et al., 2008) in the process of defining terms
L2:71 Teacher	Maximum value	**RV**	'D' - which suggests teacher re-voices learners' answers (Enyedy et al., 2008) in the process of defining terms

L2:83 Teacher	Highest,	**RV**	'D' - which suggests teacher re-voices learners' answers (Enyedy et al., 2008) in the process of defining terms
L2:99 Teacher	Sixteen, okay and thirty five, (-) okay let us see, you say half is sixteen,	**RV**	'D' - which suggests teacher re-voices learners' answers (Enyedy et al., 2008) in the process of defining terms
L2:113 Teacher	Thirty six,	**RV**	'D' - which suggests teacher re-voices learners' answers (Enyedy et al., 2008) in the process of defining terms
L2:115 Teacher	x bar is equal to the sum of all squares	**RV**	'D' - which suggests teacher re-voices learners' answers (Enyedy et al., 2008) in the process of defining terms
L2:121 Teacher	No,	**RV**	'D' - which suggests teacher re-voices learners' answers (Enyedy et al., 2008) in the process of defining terms
L2:123 Teacher	Yes you must use this formula	**RV**	'D' - which suggests teacher re-voices learners' answers (Enyedy et al., 2008) in the process of defining terms

What this table illustrates is that:

- The teacher is re-voicing learner's answer. This implies that the teacher sometimes re-voices learners' ideas about the mathematical terms for others to hear what other learners would have said (Enyedy et al., 2008; Herbel-Eisenmann et al., 2008). Also implied is that the teacher is accepting learners' ideas about the term (Moschkovich, 1999) and wants other learners to understand the contribution clearly (Pressley et al, 1989).
- Re-voicing learners' answers shows teacher's feelings and the importance attached to the definition of the term. It also implies that the teacher exhibits good listening skills which are necessary in fostering fruitful interactions in class (Davis, 1997).
- Re-voicing occurred in lessons 1 and 2 only implying that it is where terms were being explained, and the frequency of re-voicing in both the lessons seems to be high and balancing depicting a highly interactive class. Also implied by this high frequency is that important utterances in the explanation of terms must be re-voiced as areas to note.

- Re-voicing did not occur in lesson 4 because there was no explanation of terms taking place.
- The teacher used both ordinary and mathematical languages in re-voicing and this suggests the inter-change of these languages by the teacher with the intention to cater for multilingualism in class.

Speaker	Utterance	Code	Comment
L1:5 Teacher	Okay let's just write it even though	**WLI**	'D' – writing leaner idea on the board, it suggests teacher's interactive/authoritative approach (Scott et al., 2006), to teaching terminology she is the one who decides to write or not to write by saying "let's just write it"
L1:16 Teacher	Q1 [writes Q1 on the board]	**WLI**	'D' – writing leaner idea on the board, suggest teacher's interactive/authoritative approach (Scott et al., 2006), to teaching terminology
L1:26 Teacher	Upper quartile [writing on the board]	**WLI**	'D' – writing leaner idea on the board, suggest teacher's interactive/authoritative approach (Scott et al., 2006), to teaching terminology because the teacher wrote learners' answer on the board.
L2:115 Teacher	Good, x bar is equal to the sum of all squares [writing the formula on the chalkboard]	**WLI**	'D' – writing leaner idea on the board, suggest teacher's interactive/authoritative approach (Scott et al., 2006), to teaching terminology

What this table illustrates is that:

- The teacher writes learner's ideas on the chalkboard. This implies that the class was interactive and the teacher considers learners' ideas about the term in question. Also implied is that learner's ideas are used as references when they are on the board.
- The board, in this case, is used as a 'thought pad' where everyone including the owner of the idea is made to see and read individuals' thinking and use those thoughts to access correct definitions of terms together as a class. It also suggests that misconceptions about the team in question at this stage, as robust as they are at times to change, can be dealt with as most thoughts will be on the board.

Speaker	Utterance	Code	Comment
L1:24 Teacher	it is the middle value of that data when the data is arranged in order of size, right,	**AE** **RMD**	'D' – remoulding, it suggests that the teacher remoulds and adds to learner's explanations as she leads learners towards predetermined definitions. This is so because the teacher remoulds leaner's response using the textbook definition.
L1:42 Teacher	Arrange the data in ascending order, quickly do that,	**AE** **RMD**	'D' – remoulding, it suggests that the teacher remoulds and adds to learner's explanations as she leads learners towards predetermined definitions. This is so because the teacher remoulds leaner's response using the textbook definition.
L2:103 Teacher	*Ja* {yes} we must take score number sixteen plus score number seventeen add them together and divide by two, is it what you did,	**AE** **RMD**	'D' – remoulding, it suggests that the teacher remoulds and adds to learner's explanations as she leads learners towards predetermined definitions. This is so because the teacher remoulds leaner's response using the textbook definition.
L2:115 Teacher	Good, x bar is equal to the sum of all squares	**AE** **RMD**	'D' – remoulding, it suggests that the teacher remoulds and adds to learner's explanations as she leads learners towards predetermined definitions. This is so because the teacher remoulds leaner's response using the textbook definition.

What this table indicate is that:

- The teacher is remoulding and adding to learner's explanations. This implies that the teacher sometimes remoulds and adds to learners' explanations on the mathematical terms for others to hear what other learners have said (Herbel-Eisenmann et al., 2008). Also implied is that the teacher is accepting learners' explanations about the term (Moschkovich, 1999) and wants other learners to understand the explanations clearly (Pressley et al, 1989).
- Remoulding and adding to explanations occurred in lessons 1 and 2 only implying that it is where terms were being explained, and the frequency of remoulding in both the lessons seems to be low and balancing depicting learners' level of understanding of what they are expected of in terms of the mathematical language and knowledge of the terms to be defined. Also implied is that the teacher is helping learners how to communicate mathematically by modelling correctly the mathematical discourse i.e. to be able to use the mathematical

terminology appropriately by restating learners' explanations in more precise mathematical terms through remoulding and adding to their explanations.

- Remoulding and adding to explanations suggests that the teacher provides learners with access to mathematical terms and ways of talking (Gee, 2005; Khisty & Chval, 2002) therefore, mathematical terms are explicitly taught.
- Remoulding and adding to explanations did not occur in lesson 4 because there was no explanation of terms taking place.
- The teacher used the mathematical language to remould and add to the explanations, this suggests that the teacher was providing the appropriate use of mathematical terminology in the abstraction level so that learners would access both the terminology and its place in mathematics. At the same time bringing multilingual learners together into the community of mathematics learners. That is, to talk like, think like, believe like, and value like...mathematicians (Gee, 2005).
- The teacher is using the language which is acceptable in mathematics to imply the development of mathematical talk in learners which is different from other ways of talking.

Speaker	**Utterance**	**Code**	**Comment**
L1:30 Teacher	but what are we looking for	**PLQ**	This is indicative of 'D' practice in the classroom. It suggests that learners are involved in the definition of terms because the teacher asks a question intending to get a response from learners. The teacher is probing
L1:51 Teacher	people did we arrange from the highest to the lowest, yes or no	**PLQ**	An indicative of a 'D' practice, prodding learners using questions which lead to a predetermined definition in level IR2/3, the teacher probes to learners to arrange from the highest to the lowest score of the data.
L1:53 Teacher	we have the range there, what is the highest score there	**PLQ**	An indicative of a 'D' practice, prodding learners using questions which lead to a predetermined definition in level IR2/3, the teacher probes to learners to give the highest score of the data.

This table indicates:

- The teacher's prodding questions which are also leading questions. This suggests that the teacher sometimes uses prodding leading questions to get learners to come up with the correct predetermined explanation of the term. Also implied is that the teacher was leading learners through in the explanation of terms.
- The use of prodding questions by the teacher could also mean that the teacher prods more information about the term from learners as a way of evaluating how much understanding the learners have about the term in question.
- The teacher used both ordinary and mathematical languages in the prodding and this suggests the inter-change of these languages by the teacher with the intention to cater for multilingualism in class.
- Prodding leading questions were observed in lesson 1 as the data depicts (see transcripts) and not in other lessons which suggests that learners were still struggling with the definitions in lesson 1 while in the other lessons they had grasped some knowledge about the terms because the class was dealing with the same terms in all the lessons. Also implied is that for the teacher to facilitate learners' access to terminology she had to allow long exchanges focusing on one term, phrase or a particular group of words at a time, this was defined and coded as LE in the analytical framework.

Speaker	**Utterance**	**Code**	**Comment**
L1:75 Teacher	Q1 what is Q1, the first quartile and the minimum value, are they the same	**DM**	A practice in the 'D' which suggests that the teacher differentiates meanings of terms in the explanation.
L1:77 Teacher	what is the difference between first quartile and minimum value, third quartile and maximum value,	**DM**	A practice in the 'D' which suggests that the teacher differentiates meanings of terms in the explanation.
L2:117 Teacher	The mean not the median, this is the mean, why is it the mean not the median	**DM**	A practice in the 'D' which suggests that the teacher differentiates meanings of terms in the explanation.

This table indicates that:

- There were questions asking for differences of terms. This suggests that the teacher sometimes ask learners to give the difference between terms. Also implied is that the teacher facilitates learners' access to terminology by differentiating the term from what it is not for it is argued by Marton et al (2004) and Runesson (2005) that, it is easy to know something from what it is not.

- Asking learners to give the difference between terms may also imply that the teacher was evaluating learners' understanding of the terms in question.
- The teacher used the mathematical language in the questioning to provide the appropriate use of mathematical terminology in the abstraction level so that learners would access both the terminology and its place in mathematics. At the same time bringing the multilingual learners together into a community of mathematics learners. That is, to talk like, think like, believe like, and value like...mathematicians (Gee, 2005).
- The teacher is using the language which is acceptable in mathematics to imply the development of mathematical talk in learners which is different from other ways of talking.

Speaker	Utterance	Code	Comment
L1:1 Teacher	What did you find from the work I gave you?	**QAS**	'D' – which suggests IRE (initiation response evaluation type of presentation) (Scott et al., 2006), and a question and answer teaching strategy in the definition of terms. The teacher is asking learners what they got from the data and the answer is 'range', this is the term she was intending to teach because she allowed a long exchange on its explanation. It also suggests preparation work is given to learners
L1:5 Teacher	saying the range, how do you define the range, what is the range	**QAS**	'D' – which suggests IRE (initiation response evaluation type of presentation) (Scott et al., 2006), and a question and answer teaching strategy in the definition of terms. This is one of the strategies the teacher is using – getting the definition from the learners.
L1:14 Teacher	What's the abbreviation of the lower quartile	**QAS**	'D' – which suggests IRE (initiation response evaluation type of presentation) (Scott et al., 2006), and a question and answer teaching strategy in the definition of terms.
L1:22 Teacher	Which is the median, what is the median,	**QAS**	'D' – which suggests IRE (initiation response evaluation type of presentation) (Scott et al., 2006), and a question and answer teaching strategy in the definition of terms.
L1:24	Next what is the third quartile	**QAS**	'D' – which suggests IRE (initiation response evaluation type of presentation) (Scott et al.,

Teacher			2006), and a question and answer teaching strategy in the definition of terms.
L1:26 Teacher	how do we abbreviate	**QAS**	'D' – which suggests IRE (initiation response evaluation type of presentation) (Scott et al., 2006), and a question and answer teaching strategy in the definition of terms.
L1:43 Teacher	Who (...) okay what is the range, can you define range, if not yet understood	**QAS**	'D' – which suggests IRE (initiation response evaluation type of presentation) (Scott et al., 2006), and a question and answer teaching strategy in the definition of terms.
L1:47 Teacher	What is the range here, what is the range,	**QAS**	'D' – which suggests IRE (initiation response evaluation type of presentation) (Scott et al., 2006), and a question and answer teaching strategy in the definition of terms.
L1:49 Teacher	what is your range here,	**QAS**	'D' – which suggests IRE (initiation response evaluation type of presentation) (Scott et al., 2006), and a question and answer teaching strategy in the definition of terms.
	what is the range	**QAS**	'D' – which suggests IRE (initiation response evaluation type of presentation) (Scott et al., 2006), and a question and answer teaching strategy in the definition of terms.
L1:53 Teacher	we have the range there, what is the highest score there	**QAS**	'D' – which suggests IRE (initiation response evaluation type of presentation) (Scott et al., 2006), and a question and answer teaching strategy in the definition of terms.
L1:63 Teacher	The median number is the middle number which one is the middle number	**QAS**	'D' – which suggests IRE (initiation response evaluation type of presentation) (Scott et al., 2006), and a question and answer teaching strategy in the definition of terms.

L1:71 Teacher	so you see that's why the median is not the same, so how did you define the median,	**QAS**	'D' – which suggests IRE (initiation response evaluation type of presentation) (Scott et al., 2006), and a question and answer teaching strategy in the definition of terms.
	what does middle mean	**QAS**	'D' – which suggests IRE (initiation response evaluation type of presentation) (Scott et al., 2006), and a question and answer teaching strategy in the definition of terms.
L1:73 Teacher	you said your median is what?	**QAS**	'D' – which suggests IRE (initiation response evaluation type of presentation) (Scott et al., 2006), and a question and answer teaching strategy in the definition of terms.
L1:75 Teacher	what is the median and give me your answer (...) not at all,	**QAS**	'D' – which suggests IRE (initiation response evaluation type of presentation) (Scott et al., 2006), and a question and answer teaching strategy in the definition of terms.
	Q1 what is Q1, the first quartile and the minimum value, are they the same	**QAS**	'D' – which suggests IRE (initiation response evaluation type of presentation) (Scott et al., 2006), and a question and answer teaching strategy in the definition of terms.
L1:77 Teacher	what is the difference between first quartile and minimum value, third quartile and maximum value, okay	**QAS**	'D' – which suggests IRE (initiation response evaluation type of presentation) (Scott et al., 2006), and a question and answer teaching strategy in the definition of terms.
L1:88 Teacher	what is the median?	**QAS**	'D' – which suggests IRE (initiation response evaluation type of presentation) (Scott et al., 2006), and a question and answer teaching strategy in the definition of terms
L2:8	How many scores are there?	**QAS**	'D' – which suggests IRE (initiation response evaluation type of presentation) (Scott et al.,

Teacher			2006), and a question and answer teaching strategy in the definition of terms.
L2:19 Teacher	what did you write, what is your lower quartile,	**QAS**	'D' – which suggests IRE (initiation response evaluation type of presentation) (Scott et al., 2006), and a question and answer teaching strategy in the definition of terms.
	how do you find the lower quartile	**QAS**	'D' – which suggests IRE (initiation response evaluation type of presentation) (Scott et al., 2006), and a question and answer teaching strategy in the definition of terms.
L2:29 Teacher	How do you find the lower quartile tell us	**QAS**	'D' – which suggests IRE (initiation response evaluation type of presentation) (Scott et al., 2006), and a question and answer teaching strategy in the definition of terms.
L2:41 Teacher	Brenda what is the range?	**QAS**	'D' – which suggests IRE (initiation response evaluation type of presentation) (Scott et al., 2006), and a question and answer teaching strategy in the definition of terms.
L2:43 Teacher	And what is the inter quartile… [disagreeing with Brenda's answer]	**QAS**	'D' – which suggests IRE (initiation response evaluation type of presentation) (Scott et al., 2006), and a question and answer teaching strategy in the definition of terms.
L2:113 Teacher	how did you write the formula, how do we write our formula	**QAS**	'D' – which suggests IRE (initiation response evaluation type of presentation) (Scott et al., 2006), and a question and answer teaching strategy in the definition of terms.
L2:119 Teacher	how did you calculate the mean	**QAS**	'D' – which suggests IRE (initiation response evaluation type of presentation) (Scott et al., 2006), and a question and answer teaching strategy in the definition of terms.
L2:121 Teacher	how must you calculate the mean	**QAS**	'D' – which suggests IRE (initiation response evaluation type of presentation) (Scott et al., 2006), and a question and answer teaching strategy in the definition of terms.

P-R1	I normally ask them questions relating to what I want to introduce	**QAS**	'D' – which suggests IRE (initiation response evaluation type of presentation) (Scott et al., 2006), and a question and answer teaching strategy in the definition of terms.
	I just switch to questions of wanting to know what they know about that	**QAS**	'D' – which suggests IRE (initiation response evaluation type of presentation) (Scott et al., 2006), and a question and answer teaching strategy in the definition of terms.
P-R2	I will ask them some questions	**QAS**	'D' – which suggests IRE (initiation response evaluation type of presentation) (Scott et al., 2006), and a question and answer teaching strategy in the definition of terms.
P-R7	and ask questions, and when they give some responses	**QAS**	'D' – which suggests IRE (initiation response evaluation type of presentation) (Scott et al., 2006), and a question and answer teaching strategy in the definition of terms

This table indicates:

- A question and answer pattern that the teacher was using in the explanation of terms. This suggests that the teacher was using a question and answer teaching strategy in the explanation of mathematical terms. And also implied is that the teacher involved learners in the explanation.
- The question and answer strategy occurred in lessons 1 and 2 only implying that it is where terms were being explained, and the frequency of questioning in both the lessons seems to be high and almost balancing implying that the teacher used question and answer as a teaching strategy to interact with the groups in the definition of the terms. The frequency also shows that it was a highly interactive class.
- Question and answer did not occur in lesson 4 because there was no explanation of terms taking place instead learners were now applying and using the knowledge of mathematical terms to answer question papers.
- The teacher used both ordinary and mathematical languages in the question and response and this suggests the inter-change of these languages by the teacher with the intention to cater for multilingualism in class.

Speaker	Utterance	Code	Comment
L1:1 Teacher	…and you were working in groups so each group should tell us what they did, ok.	**GWS**	'D' – group work, it suggests teacher's teaching strategy which creates and engages learners in sound CIT1 pattern of interaction when teaching mathematical terms (Scott et al., 2006). This is so because the teacher gave learners work to do in groups and now each group is to report back.
L1:34 Teacher	there it says... in your groups	**GWS**	'D' – group work, it suggests teacher's teaching strategy which creates and engages learners in sound CIT1 pattern of interaction when teaching mathematical terms (Scott et al., 2006). The teacher is authoritatively asking learners to do exercise eight point six in groups.
L1:36 Teacher	I want you in your groups (...) on the data;	**GWS**	'D' – group work, it suggests teacher's teaching strategy which creates and engages learners in sound CIT1 pattern of interaction when teaching mathematical terms (Scott et al., 2006)
L1:38 Teacher	Five number summary	**GWS**	'D' – group work, it suggests teacher's teaching strategy which creates and engages learners in sound CIT1 pattern of interaction when teaching mathematical terms (Scott et al., 2006)
L1:59 Teacher	okay there is a hand [going to one of the groups],	**GWS**	'D' – group work, it suggests teacher's teaching strategy which creates and engages learners in sound CIT1 pattern of interaction when teaching mathematical terms (Scott et al., 2006)
L1:69 Teacher	are you working as a whole group	**GWS**	'D' – group work, it suggests teacher's teaching strategy which creates and engages learners in sound CIT1 pattern of interaction when teaching mathematical terms (Scott et al., 2006)
L1:71 Teacher	you are not working in a group, you must discuss as a group,	**GWS**	'D' – group work, it suggests teacher's teaching strategy which creates and engages learners in sound CIT1 pattern of interaction when teaching mathematical terms (Scott et al., 2006)
L1:75	or we want sixty seven and sixty two, right let's discuss in	**GWS**	'D' – group work, it suggests teacher's teaching strategy which creates and engages learners

Teacher	groups, two minutes		in sound CIT1 pattern of interaction when teaching mathematical terms (Scott et al., 2006)
L1:77 Teacher	are you working as a group, you must work as a group, so discuss,	**GWS**	'D' – group work, it suggests teacher's teaching strategy which creates and engages learners in sound CIT1 pattern of interaction when teaching mathematical terms (Scott et al., 2006)
L1:86 Teacher	Right, any group which have done the stem and leaf	**GWS**	'D' – group work, it suggests teacher's teaching strategy which creates and engages learners in sound CIT1 pattern of interaction when teaching mathematical terms (Scott et al., 2006)
L1:92 Teacher	Brenda you must remind your group mates,	**GWS**	'D' – group work, it suggests teacher's teaching strategy which creates and engages learners in sound CIT1 pattern of interaction when teaching mathematical terms (Scott et al., 2006)
L2:1 Teacher	[The class monitor had collected and handed out learners' marked group work just before the lesson had started.	**GWS**	'D' – group work, it suggests teacher's teaching strategy which creates and engages learners in sound CIT1 pattern of interaction when teaching mathematical terms (Scott et al., 2006)
	Which group can present the stem and leaf of	**GWS**	'D' – group work, it suggests teacher's teaching strategy which creates and engages learners in sound CIT1 pattern of interaction when teaching mathematical terms (Scott et al., 2006)
L2:53 Teacher	which group?	**GWS**	'D' – group work, it suggests teacher's teaching strategy which creates and engages learners in sound CIT1 pattern of interaction when teaching mathematical terms (Scott et al., 2006)
L2:55 Teacher	Which group, you, right okay let's look at what Brenda has drawn there	**GWS**	'D' – group work, it suggests teacher's teaching strategy which creates and engages learners in sound CIT1 pattern of interaction when teaching mathematical terms (Scott et al., 2006)

L2:63 Teacher	next group, they are fine, you are also fine,	**GWS**	'D' – group work, it suggests teacher's teaching strategy which creates and engages learners in sound CIT1 pattern of interaction when teaching mathematical terms (Scott et al., 2006)
L2:73 Teacher	in your groups	**GWS**	'D' – group work, it suggests teacher's teaching strategy which creates and engages learners in sound CIT1 pattern of interaction when teaching mathematical terms (Scott et al., 2006)
L4:1 Teacher	their group past exam question papers	**GWS**	'D' – group work, it suggests teacher's teaching strategy which creates and engages learners in sound CIT1 pattern of interaction when teaching mathematical terms (Scott et al., 2006)
	after you have discussed with people in your group,	**GWS**	'D' – group work, it suggests teacher's teaching strategy which creates and engages learners in sound CIT1 pattern of interaction when teaching mathematical terms (Scott et al., 2006)
L4:3 Teacher	Are you discussing with your group? [leaving the class for a meeting]	**GWS**	'D' – group work, it suggests teacher's teaching strategy which creates and engages learners in sound CIT1 pattern of interaction when teaching mathematical terms (Scott et al., 2006)
P-R4	I send them in their groups, and these are permanent groups in that class,	**GWS**	'D' – group work, it suggests teacher's teaching strategy which creates and engages learners in sound CIT1 pattern of interaction when teaching mathematical terms (Scott et al., 2006)
P-R7	I find group work and report back working well for me,	**GWS**	'D' – group work, it suggests teacher's teaching strategy which creates and engages learners in sound CIT1 pattern of interaction when teaching mathematical terms (Scott et al., 2006)

This table indicates:

- A group work pattern that the teacher was using in the explanation of terms. This suggests that the teacher was using a group work teaching strategy in addition to question and answer teaching strategy in the explanation of mathematical terms. And also implied is that the teacher involved learners in the explanation.

- The group work strategy occurred in lessons 1 and 2 only implying that it is where terms were being explained, and the frequency of questioning in both the lessons seems to be high and almost balancing implying that the teacher used group work as a teaching strategy to interact with the groups in the process of defining the terms. The frequency also shows that it was a highly interactive class.
- Group work did not occur in lesson 4 because there was no explanation of terms taking place instead learners were now applying and using the knowledge of mathematical terms to answer question papers.
- The teacher used both ordinary and mathematical languages to interact with the groups and this suggests the inter-change of these languages by the teacher with the intention to cater for multilingualism in class.
- The teacher addresses learners as in groups. This implies that there was group-teacher interaction as a teaching strategy which seemed to create and engage learners in a sound pattern of interaction with the teacher as they were defining the mathematical terms (Scott et al., 2006).
- Addressing learners' in groups occurred in all the lessons implying that the classroom interaction taking place in this class was a CIT type 1 (CIT1). The teacher also indicated in the interview that she sends learners to do the work in their permanent groups, and that she finds group work and report back more effective in teaching and learning terminology (P-R4 & P-R7), this implies she uses group work as an effective teaching strategy in the explanation of mathematical terms.

Speaker	**Utterance**	**Code**	**Comment**
L1:24 Teacher	Right, it is the middle value of that data when the data is arranged in order of size	**STB**	This is indicative of 'D', i.e. source of definition. It suggests that the teacher uses a textbook as a source of definitions. This is so because the descriptive explanation she gave here, from my experience as a mathematics teacher, is a textbook one.
L1:100 Teacher	read again on quartiles in your textbooks to understand them	**STB**	This is indicative of 'D' practice in the classroom. It suggests that learners are encouraged to read about terms from the textbook, the teacher tells learners to read on quartiles in their textbooks. It also suggests that textbooks are used as sources of definition
L2:65	right lets read here[looking in the textbook],	**STB**	This is indicative of 'D', i.e. source of definition. It suggests that

Teacher			the teacher uses a textbook as a source of definitions
L2:71 Teacher	just turn on page one hundred and ninety four and read there about skewed and symmetrical data then analyse your box and whiskers	**STB**	This is indicative of 'D', i.e. source of definition. It suggests that the teacher uses a textbook as a source of definitions
L2:89 Teacher	now if you had your textbook, you would be comparing how many	**STB**	This is indicative of 'D', i.e. source of definition. It suggests that the teacher uses a textbook as a source of definitions
P-R4	…so that they know what is it that becomes data when they find it in their textbooks.	**STB**	This is indicative of 'D', i.e. source of definition. It suggests that the teacher uses a textbook as a source of definitions
P-R5	I stick to the mathematical definitions of the textbook only	**STB**	This is indicative of 'D', i.e. source of definition. It suggests that the teacher uses a textbook as a source of definitions
	…we teach towards examinations it is better to teach what is commonly accepted and we know what is commonly accepted is in the textbook…	**STB**	This is indicative of 'D', i.e. source of definition. It suggests that the teacher uses a textbook as a source of definitions
	when they hear the same word being used in different contexts they should know the mathematical meaning	**STB**	This is indicative of 'D', i.e. source of definition. It suggests that the teacher uses a textbook as a source of definitions
P-R7	I finalise by explaining the term according to the textbook we are using in class.	**STB**	This is indicative of 'D', i.e. source of definition. It suggests that the teacher uses a textbook as a source of definitions because the teacher finalises by explaining the term according to the textbook

What this table illustrates is that:

- There were some indications of textbook use in the definition of the terms. In most utterances the teacher has mentioned and emphasised on the use of the textbook, this implies that the teacher uses the textbook as the source of definition of the mathematical terms.
- The remoulded explanation that the teacher gave for the term 'median' in L1:24, from my experience as a mathematics teacher, is a textbook type. This also shows that the teacher was using the textbook as a source of definition; therefore, the teacher leads the class to predetermined conventional definition of terms by using the textbook.
- In the interview the teacher indicated that she uses the textbook mathematical definitions, teaches what is commonly accepted and refers to the textbook when teaching (P-R5 & P-R7). She also indicated that learners must use the textbook for mathematical meanings (P-R4 & P-R5). This implies that the teacher relied on the textbook as the source of definitions, therefore, she used formal definitions given by the text (Moschkovich, 2003) and they are conventional.

Speaker	**Utterance**	**Code**	**Comment**
L2:65 Teacher	right lets read here[looking in the textbook],some books when they talk about skewed, they are saying a symmetrical data set is balanced or you heard so	**DS**	An indicative of 'D', i.e. source of definition. It suggests that the teacher also accepts different source of definitions
P-R4	I use any source of information available which can help me to make the learners understand,	**DS**	An indicative of 'D', i.e. source of definition. It suggests that the teacher also accepts different source of definitions
	I also encourage my learners to go and ask other people especially teachers here at school even after I have taught them the terminology or to read around	**DS**	An indicative of 'D', i.e. source of definition. It suggests that the teacher also accepts different source of definitions and that, learners are free to source information around.

What this table shows is that:

- There are some indications of the use of different sources of definitions of the terms. The table shows only one utterance of the teacher mentioning what other books' definitions of terms. This implies that the teacher accepts the use of other sources of definition.
- The interview information (P-R4) indicates that the teacher uses any available sources which can help learners understand the terms and that she encourages learners to ask other people and to read around about the mathematical terms, though, it was not the case in the

lessons, this suggests that the teacher also uses other sources with appropriate mathematical definitions other than the textbook only to help her reach for learners' understanding.

Speaker	Utterance	Code	Comment
L1:36 Teacher	find the range and	**PQ**	'D'– which suggests IRE (initiation response evaluation type of presentation) (Scott et al., 2006), and a question and answer teaching strategy in the definition of terms. The question is requiring learners to calculate and find the range of the data, therefore, understanding the term from its calculational premises.
L1:38 Teacher	okay, what is the first step, what do you do [moving around the class helping the groups]	**PQ**	'D' – which suggests IRE (initiation response evaluation type of presentation) (Scott et al., 2006), and a question and answer teaching strategy in the definition of terms. The question is requiring learners to identify the steps followed in finding the 'range' of the data, therefore, understanding the term from its calculational premises.
L1:45 Teacher	Quickly calculate it	**PQ**	'D' – which suggests IRE (initiation response evaluation type of presentation) (Scott et al., 2006), and a question and answer teaching strategy in the definition of terms. The question is requiring learners to calculate and find the range of the data, therefore, understanding the term from its calculational premises.
L1:47 Teacher	What is the range here, what is the range	**PQ**	'D' - procedural question, it suggests that the teacher uses procedural questions in facilitating learners' access to terminology in the explanation of terms. The question requires learners to find 'range' in value form
L1:49 Teacher	what is your range here,	**PQ**	'D' - procedural question, it suggests that the teacher uses procedural questions in facilitating learners' access to terminology in the explanation of terms. The question requires learners to find 'range' in value form

	what is the range	**PQ**	'D' - procedural question, it suggests that the teacher uses procedural questions in facilitating learners' access to terminology in the explanation of terms. Such question asks for a calculated value 'range'
L1:51 Teacher	people did we arrange from the highest to the lowest,	**PQ**	'D' - procedural question, it suggests that the teacher uses procedural questions in facilitating learners' access to terminology in the explanation of terms. Such question leads to calculational understanding of the term 'range'.
L1:53 Teacher	find the highest score, find the lowest score	**PQ**	'D' - procedural question, it suggests that the teacher uses procedural questions in facilitating learners' access to terminology in the explanation of terms. The question requires learners to give a calculated value 'range'
L1:67 Teacher	Which one is in the middle	**PQ**	'D' - procedural question, it suggests that the teacher uses procedural questions in facilitating learners' access to terminology in the explanation of terms. Such question leads to calculational understanding of the term 'median'.
L1:75 Teacher	what is the median and give me your answer	**PQ**	'D' - procedural question, it suggests that the teacher uses procedural questions in facilitating learners' access to terminology in the procedural explanation of terms. This question is derived from an utterance of certain numbers by the teacher; therefore, it requires learners to explain a solution method of getting the median of that data.
L1:88 Teacher	Stem and leaf how did you get this,	**PQ**	'D' - procedural question, it suggests that the teacher uses procedural questions in facilitating learners' access to terminology in the procedural explanation of terms. The question "how did you get this" requires the learner to explain a solution method which gave the king of an answer
	what is the median?	**PQ**	'D' - procedural question, it suggests that the teacher uses procedural questions in

			facilitating learners' access to terminology in the explanation of terms.
L2:19 Teacher	how do you find the lower quartile	**PQ**	'D' - procedural question, it suggests that the teacher uses procedural questions in facilitating learners' access to terminology in the explanation of terms.
L2:29 Teacher	How do you find the lower quartile tell us	**PQ**	'D' - procedural question, it suggests that the teacher uses procedural questions in facilitating learners' access to terminology in the explanation of terms.
L2:39 Teacher	Who wants to come and do the range for us	**PQ**	'D' - procedural question, it suggests that the teacher uses procedural questions in facilitating learners' access to terminology in the explanation of terms.
L2:41 Teacher	Brenda what is the range	**PQ**	'D' - procedural question, it suggests that the teacher uses procedural questions in facilitating learners' access to terminology in the explanation of terms.
L2:43 Teacher	And what is the inter quartile… [disagreeing with Brenda's answer]	**PQ**	'D' - procedural question, it suggests that the teacher uses procedural questions in facilitating learners' access to terminology in the explanation of terms.
L2:91 Teacher	*Ja* {yes} have you found the median	**PQ**	'D' - procedural question, it suggests that the teacher uses procedural questions in facilitating learners' access to terminology in the explanation of terms.
L2:119 Teacher	but how did you calculate the mean, ja {yes},	**PQ**	'D' - procedural question, it suggests that the teacher uses procedural questions in facilitating learners' access to terminology in the explanation of terms.
L2:121 Teacher	so how must you calculate the mean	**PQ**	'D' - procedural question, it suggests that the teacher uses procedural questions in facilitating learners' access to terminology in the explanation of terms.
P-R1	Because we were looking at averages I just asked them to find their average mark of the list	**PQ**	'D' - procedural question, it suggests that the teacher uses procedural questions in facilitating learners' access to terminology in the explanation of terms.

What this table illustrates is that:

- The teacher was asking procedural questions. This implies that the teacher was facilitating learners' access to terminology through what Essien (2011) referred to as a procedural Discourse.
- Procedural questions occurred in lessons 1 and 2 only implying that it is where terms were being explained, and the frequency of the questions in both the lessons seemed to be high and balancing implying that the teacher used the procedural questions to facilitate learners' access to mathematical terminology while interacting with the groups. Also depicted is a highly interactive class.
- Procedural questions did not occur in lesson 4 because there was no explanation of terms taking place.
- The teacher used both ordinary and mathematical languages to ask procedural questions, this suggests the inter-change of these languages by the teacher with the intention to cater for multilingualism in class.

Speaker	**Utterance**	**Code**	**Comment**
L1:6 Class	Highest score minus lowest score	**PE**	It is an indication of 'D' practice and it suggests that the teacher accepts procedural way of defining the term. This is shown by the whole class defining the term 'range' in a procedural way.
L1:34 Teacher	they said find the range using the formula that the range is equal to highest score minus...	**PE**	A procedural explanation, in defining the term and is of level IR2, is part of the 'D', range was defined through using the formula as 'highest score minus... lowest score' it shows that this way of defining terms is accepted.
L1:64 Learner	Between sixty seven and sixty two	**PE**	It is an indication of 'D' practice and it suggests that the teacher accepts the meaning of the term in value form which is obtained from a procedural way of finding median.
L1:72 Joy	Number in between	**PE**	It is an indication of 'D' practice and it suggests that the teacher accepts the meaning of the term in value form which is obtained from a procedural way.

L1:74 Joy	Number in between the one this side and the other that side	**PE**	A procedural explanation, in defining the term and is of level IR2, is part of the ‘D’, it shows that this way of defining terms is accepted. Joy is describing where the median is found according to the data they are using and the teacher acknowledges it by reminding Joy to write it.
L1:80 Learner	Three numbers after (...) find the lower quartile, the next Q1 okay between Q1 and (...)	**PE**	A procedural explanation, in defining the term and is of level IR2, is part of the ‘D’, it shows that this way of defining terms is accepted. The learner is describing how lower quartile is found according to the data they are using.
L1:85 Teacher	When you divide data into two parts then you get the median from there, take the first half, find the middle quartile, find range, lower quartile, upper quartile	**PE**	A procedural explanation, in defining the term and is of level IR2, is part of the ‘D’, it shows that this way of defining terms is accepted
L1:88 Teacher	right thirty two divide by two now,	**PE**	A procedural explanation, in defining the term and is of level IR2, is part of the ‘D’, it shows that this way of defining terms is accepted.
L1:89 Brenda	Number between numbers 36,6	**PE**	It is an indication of ‘D’ practice and it suggests that the teacher accepts the meaning of the term in value form which is obtained from a procedural way of finding median
L1:94 Teacher	divide your data into two, take the first half divide into two, take the other half and divide into two again so that you get your quartile two,	**PE**	A procedural explanation, in defining the term and is of level IR2, is part of the ‘D’, it shows that this way of defining terms is accepted.
L2:14 Brenda	I look for my lower quartile then I found its twenty three, then my median is twenty three plus twenty four divide by two because lower	**PE**	A procedural explanation, in defining the term and is of level IR2, is part of the ‘D’, the learner is procedurally defining the lower quartile it shows that

	quartile is also median		this way of defining terms is accepted.
L2:16 Brenda	I find the median of the whole numbers, then I find the median of the half because median of the lower is the lower quartile	**PE**	A procedural explanation, in defining the term and is of level IR2, is part of the 'D', it shows that this way of defining terms is accepted.
L2:20 Joy	I divided the positive two by two…	**PE**	A procedural explanation, in defining the term and is of level IR2, is part of the 'D', it shows that this way of defining terms is accepted.
L2:24 Joy	We divide our data into two, then we calculate the median	**PE**	A procedural explanation, in defining the term and is of level IR2, is part of the 'D', it shows that this way of defining terms is accepted.
L2:26 Joy	Then I look for the lower quartile I found that its twenty three	**PE**	A procedural explanation, in defining the term and is of level IR2, is part of the 'D', it shows that this way of defining terms is accepted.
L2:33 Peter	you take two numbers to get your middle number and then add them and divide by two and its going to be sixteen plus fifteen then you get thirty one divide by two which is equal to fifteen coma five and that means end quartile	**PE**	A procedural explanation, in defining the term and is of level IR2, is part of the 'D', it shows that this way of defining terms is accepted.
L2:40 Joe	Yes, [coming to the board] the range, I find the highest number, for this one the range will be (...)	**PE**	A procedural explanation, in defining the term and is of level IR2, is part of the 'D', it shows that this way of defining terms is accepted.
L2:65 Teacher	This is good what you are doing, then calculate thirty three minus twenty three. It's what? Twenty three coma five minus fifteen,	**PE**	A procedural explanation, in defining the term and is of level IR2, is part of the 'D', it shows that this way of defining terms is accepted.

L2:87 Teacher	so find the middle, divide the data into two, divide the data into two,	**PE**	A procedural explanation, in defining the term and is of level IR2, is part of the 'D', it shows that this way of defining terms is accepted.
L2:103 Teacher	*Ja* {yes} we must take score number sixteen plus score number seventeen add them together and divide by two	**PE**	A procedural explanation, in defining the term and is of level IR2, is part of the 'D', it shows that this way of defining terms is accepted.
L2:107 Teacher	Thirty five and thirty seven divide by…	**PE**	Leaving incomplete sentences is a way of talking the teacher allows (Gee, 2005); therefore, it is a 'D' practice she approves of because she allows learners to complete her incomplete sentence
L2:118 Mike	Yes, it is the mean because it is from the formula	**PE**	A procedural explanation, in defining the term and is of level IR2, is part of the 'D', it shows that this way of defining terms is accepted.
L2:122 Mike	You must use this formula which is x bar is equal to...	**PE**	A procedural explanation, in defining the term and is of level IR2 because they are to use the formula, is part of the 'D'; it shows that this way of defining terms is accepted.
P-R3	when the number of numbers is even they sometimes get a value which is not in their data so they get confused but when the number of numbers is odd the median is easy to pick because it appears to be the middle number	**PE**	A procedural explanation, in defining the term and is of level IR2, is part of the 'D', it shows that this way of defining terms is accepted.

What this table illustrates is that:

- There were procedural explanations which the teacher and the learners gave for the terms. This implies that the teacher accepts procedural explanations and also explains the terms procedurally. It suggests that learners' access mathematical terminology procedurally, therefore, the teacher socialises learners in the explanation of terms through a calculational Discourse (Setati, 2005b) which Essien (2011) referred to as a procedural Discourse. In the Definition Discourse, I define Calculational Discourse or procedural Discourse as when methods of calculating or procedures of finding what the term stands for in mathematics are used to explain the term.

- Procedural explanations occurred in lessons 1 and 2 only implying that it is where terms were being explained, and the frequency of the explanations in both the lessons seemed to be high and balancing implying that the teacher used the procedural explanations to facilitate learners' access to mathematical terminology while interacting with the groups. Also depicted is a highly interactive class.
- There are more utterances of procedural explanations by learners than by the teacher implying that learners are made to access terminology through procedural explanation because procedural demonstrations helps learners understand underlying mathematical principles in the terminology and thereafter understand the meaning of the term (Ball, 1990). Also implied is that procedural explanation will only enable learners to access definition of terms in the IR2 level.
- Procedural explanations did not occur in lesson 4 because there was no explanation of terms taking place.
- The teacher and the learners used both ordinary and mathematical languages in the explanations; this suggests the inter-change of these languages by the class with the intention to cater for multilingualism.

What the table is not showing is whether the procedural explanations were given after a procedural question was asked or not.

Speaker	**Utterance**	**Code**	**Comment**
L1:46 Learner	Fifty two... the range	**PR**	It is an indication of 'D' practice and it suggests a 'valued' procedural response from a learner and the teacher accepts the meaning of the term in value form which is obtained from a procedural way of finding range.
L1:48 Learner	It's forty five	**PR**	It is an indication of 'D' practice and it suggests a 'valued' procedural response from a learner and the teacher accepts the meaning of the term in value form which is obtained from a procedural way of finding range.
L1:50 Class	Forty eight	**PR**	It is an indication of 'D' practice and it suggests a 'valued' procedural response from a learner and the teacher accepts the meaning of the term in value form which is obtained from a procedural way of finding range.
L1:54 Class	Eighty two	**PR**	It is an indication of 'D' practice and it suggests a 'valued' procedural response from a learner and the teacher accepts the meaning of the term in value form which is obtained from a procedural way of finding range.

L1:56 Class	Thirty four	**PR**	It is an indication of 'D' practice and it suggests a 'valued' procedural response from a learner and the teacher accepts the meaning of the term in value form which is obtained from a procedural way of finding range.
L1:58 Class	Forty eight	**PR**	It is an indication of 'D' practice and it suggests a 'valued' procedural response from a learner and the teacher accepts the meaning of the term in value form which is obtained from a procedural way of finding range.
L1:68 Learner	Fifty	**PR**	It is an indication of 'D' practice and it suggests a 'valued' procedural response from a learner and the teacher accepts the meaning of the term in value form which is obtained from a procedural way of finding median.
L1:84 Peter	*Ihi forty six* {its forty six}	**PR**	It is an indication of 'D' practice and it suggests a 'valued' procedural response from a learner and the teacher accepts the meaning of the term in value form which is obtained from a procedural way of finding median.
L1:89 Brenda	Number between numbers 36,6	**PR**	It is an indication of 'D' practice and it suggests a 'valued' procedural response from a learner and the teacher accepts the meaning of the term in value form which is obtained from a procedural way of finding median.
L2:46 Brenda	Fifty one	**PR**	It is an indication of 'D' practice and it suggests a 'valued' procedural response from a learner and the teacher accepts the meaning of the term in value form which is obtained from a procedural way of finding range.
L2:94 Nicole	It's thirty five	**PR**	It is an indication of 'D' practice and it suggests a 'valued' procedural response from a learner and the teacher accepts the meaning of the term in value form which is obtained from a procedural way of finding median.
L2:96 Nicole	It's thirty five	**PR**	It is an indication of 'D' practice and it suggests a 'valued' procedural response from a learner and the teacher accepts the meaning of the term in value form which is obtained from a procedural way of finding median.
L2:98 Nicole	Half is sixteen	**PR**	It is an indication of 'D' practice and it suggests a 'valued' procedural response from a learner and the teacher accepts the meaning of the term in value form which is obtained from a procedural way of finding median.
L2:106	Thirty five and	**PR**	It is an indication of 'D' practice and it suggests a 'valued' procedural response from a learner and the teacher

Mike	thirty seven		accepts the meaning of the term in value form which is obtained from a procedural way of finding meanings of the term.
L2:110 Mike	Two	**PR**	It is an indication of ‘D’ practice and it suggests a ‘valued’ procedural response from a learner and the teacher accepts the meaning of the term in value form which is obtained from a procedural way of finding median.
L2:112 Mike	Thirty six	**PR**	It is an indication of ‘D’ practice and it suggests a ‘valued’ procedural response from a learner and the teacher accepts the meaning of the term in value form which is obtained from a procedural way of finding median.
L2:114 Mike	X bar is equal to the sum of...	**PR**	A procedural textbook method is part of the ‘D’. It suggests that the teacher accepts ‘valued’ procedural definition in the explanation of terms.

This table indicates that:

- Learners were giving ‘valued’ procedural responses. This implies that the teacher accepts valued’ procedural responses. It suggests that learners’ access mathematical terminology procedurally, therefore, the teacher socialises learners in the explanation of terms through a calculational Discourse (Setati, 2005b) which Essien (2011) referred to as a procedural Discourse. In the Definition Discourse, I define Calculational Discourse or procedural Discourse as when methods of calculating or procedures of finding what the term stands for in mathematics are used to explain the term. When what the term stands for has been found and given, usually it is a value form; I refer this to a ‘valued’ procedural response.
- ‘Valued’ procedural responses occurred in lessons 1 and 2 only implying that it is where terms were being explained, and the frequency of the given valued’ procedural responses in both the lessons seemed to be high and balancing implying that the teacher accepted ‘valued’ procedural responses in facilitating learners’ access to mathematical terminology while interacting with the groups. Also depicted is a highly interactive class.
- Utterances of ‘valued’ procedural responses were only from learners implying that learners readily understand the meaning of terms by getting the values of those terms because procedural demonstrations helps learners understand underlying mathematical principles in the terminology and thereafter understand the meaning (Ball, 1990). Also implied is that ‘valued’ procedural meaning will only enable learners to access definition of terms in the IR2 level.
- ‘Valued’ procedural responses did not occur in lesson 4 because there was no explanation of terms taking place.

- The learners used the mathematical language in their ‘valued’ procedural responses; this suggests that learners were skilfully developed in the use of the language and were putting the skills into practice.

What the table is not showing is whether the ‘valued’ procedural responses were given after a procedural question was asked or not.

Speaker	**Utterance**	**Code**	**Comment**
L1:34 Teacher	...they said find the range using the formula that the range is equal to highest score minus...	**F**	Using formula is indicative of ‘D’, i.e. some practice in the classroom. It suggests that the teacher facilitates learners’ access to terminology through the procedural way. The teacher asks learners to find the range using the formula.
L2:109 Teacher	you must write the formula median is equals to (-), you write the two numbers and	**F**	Using formula is indicative of ‘D’, i.e. some practice in the classroom. It suggests that the teacher facilitates learners’ access to terminology through the procedural way.
L2:113 Teacher	now what’s the formula for the mean	**F**	Using formula is indicative of ‘D’, i.e. some practice in the classroom. It suggests that the teacher facilitates learners’ access to terminology through the procedural way.
	how did you write the formula, how do we write our formula	**F**	Using formula is indicative of ‘D’, i.e. some practice in the classroom. It suggests that the teacher facilitates learners’ access to terminology through a procedural way of using a formula.
L2:115 Teacher	x bar is equal to the sum of all squares	**F**	Using formula is indicative of ‘D’, i.e. some practice in the classroom. It suggests that the teacher facilitates learners’ access to terminology through a procedural way of using a formula.
L2:118 Mike	Yes, it is the mean because it is from the formula	**F**	Using formula is indicative of ‘D’, i.e. some practice in the classroom. It suggests that the teacher facilitates learners’ access to terminology through the procedural way.

L2:122 Mike	You must use this formula which is x bar is equal to...	**F**	A procedural explanation, in defining the term and is of level IR2 because they are to use the formula, is part of the 'D'; it shows that this way of defining terms is accepted.
L2:123 Teacher	Yes you must use this formula	**F**	Using formula is indicative of 'D', i.e. some practice in the classroom. It suggests that the teacher facilitates learners' access to terminology through a procedural way of using a formula

What this table illustrates is that:

- The teacher gave an emphasis on using the formula and this implies that in the facilitation of learner access to terminology the teacher also uses formulae.
- Using the formula indicates a procedural way of explaining terms. A procedural demonstration through a formula helps learners understand underlying mathematical principles in the terminology and thereafter understand the meaning (Ball, 1990).

Speaker	**Utterance**	**Code**	**Comment**
L1:5 Teacher	saying the range, how do you define the range, what is the range	**DQ**	'D' - descriptive question, it suggests that the teacher uses descriptive questions in facilitating learners' access to terminology in the explanation of terms at the IR3. For example, the question 'why three and not…' needs Nicho to justify his answer "We only look to three…" in the justification he describes what three stands for in the quartiles. It is also a high order question
L1:10 Teacher	Three, why three and not...	**DQ**	'D' - descriptive question, it suggests that the teacher uses descriptive questions in facilitating learners' access to terminology in the explanation of terms at the IR3. For example, the question 'why three and not…' needs Nicho to justify his answer "We only look to three…" in the justification he describes what three stands for in the quartiles. It is also a high order question

L1:22 Teacher	Which is the median, what is the median,	**DQ**	'D' - descriptive question, it suggests that the teacher uses descriptive questions in facilitating learners' access to terminology in the explanation of terms at the IR3. For example, the question "who can define…" means that the teacher is looking for a descriptive explanation of the term 'median' and the explanation of it will conceptually enhance learners' understanding.
L1:43 Teacher	Who (...) okay what is the range, can you define range, if not yet understood	**DQ**	'D' - descriptive question, it suggests that the teacher uses descriptive questions in facilitating learners' access to terminology in the explanation of terms at the IR3 by providing a conceptual understanding. The question "what is the range, can you define range" solicits a conceptual explanation of the term 'range' and it aims at deepening learners' understanding of the term conceptually.
L1:71 Teacher	how did you define the median,	**DQ**	'D' - descriptive question, it suggests that the teacher uses descriptive questions in facilitating learners' access to terminology in the explanation of terms at the IR3. The question is seeking learners' conceptual understanding of the term 'median'
	what does middle mean	**DQ**	'D' - descriptive question, it suggests that the teacher uses descriptive questions in facilitating learners' access to terminology in the explanation of terms at the IR3. The question is seeking learners' conceptual understanding of the term 'middle'
L1:73 Teacher	you said your median is what?	**DQ**	'D' - descriptive question, it suggests that the teacher uses descriptive questions in facilitating learners' access to terminology in the explanation of terms at the IR3. The question is seeking learners' conceptual understanding of the term 'median'
L1:75 Teacher	Q1 what is Q1, the first quartile and the minimum value, are they the same	**DQ**	'D' - descriptive question, it suggests that the teacher uses descriptive questions in facilitating learners' access to terminology in the explanation of terms at the IR3. The question is seeking learners' conceptual understanding of the terms 'quartile' and

			'minimum value'
L1:77 Teacher	what is the difference between first quartile and minimum value, third quartile and maximum value,	**DQ**	'D' - descriptive question, it suggests that the teacher uses descriptive questions in facilitating learners' access to terminology in the explanation of terms. The question is seeking learners' conceptual understanding of a range of terms.
L2:117 Teacher	The mean not the median, this is the mean, why is it the mean not the median	**DQ**	'D' - descriptive question, it suggests that the teacher uses descriptive questions in facilitating learners' access to terminology in the explanation of terms. The question is seeking learners' conceptual understanding of the terms 'mean' and 'median'

What this table illustrates is that:

- The teacher was asking descriptive questions. This implies that the teacher alternates descriptive questions and procedural questions in the facilitation of learners' access to terminology.
- Descriptive questions call for a descriptive conceptual explanation. Setati (2005b) referred to this as a conceptual Discourse, this is where mathematical concepts are discussed or described, and therefore, the teacher was asking descriptive questions in order to get descriptive explanations for the terms. Essien (2011) understands descriptive explanations as conceptual explanations, and these promote conceptual understanding of the mathematical terms in learners (Kilpatrick et al., 2001), hence relational understanding of those terms (Skemp, 1976). This implies that learners are given an opportunity to access the terminology both procedurally and conceptually.
- It seems the teacher used the descriptive questions to engage learners in correct, meaningful, and applicable definitions of the terms thus engaging them in a mathematical sense-making (Adams, 2003). This implies that the teacher was promoting learner's conceptual development in the conceptual Discourse.
- There were more descriptive questions in lesson 1 than in 2 implying that it was a crucial moment in the explanation of terms the teacher wanted learners to get the mathematically precise and explicit definitions of the terms in the initial stages of engaging with the term. Also depicted is a highly interactive class.
- There was only descriptive question and a lot of procedural questions in lesson 2, this shows that the teacher asked more procedural questions than descriptive questions in this lesson to check if learners were able to apply their knowledge about the terms and solve problems in regards with those terms, correctly.

- Descriptive questions did not occur in lesson 4 because there was no explanation of terms taking place; learners were applying acquired knowledge to the questions on the question papers.
- The teacher used the mathematical language in the questioning to provide the appropriate use of mathematical terminology in the abstraction level so that learners would access both the terminology and its place in mathematics. At the same time bringing multilingual learners together into a community of mathematics learners. That is, to talk like, think like, believe like, and value like...mathematicians (Gee, 2005).

What the table is not showing is whether these descriptive questions were followed by descriptive explanations or not.

Speaker	Utterance	Code	Comment
L1:24 Teacher	it is the middle value of that data when the data is arranged in order of size	**DE**	A descriptive explanation, a textbook descriptive definition of the term which is of level IR3 is part of the 'D'. It suggests that the teacher accepts descriptive definition in the explanation of terms; this is indicated by the teacher's remoulding of learner's answer giving a textbook descriptive definition. The teacher re-voices the definition (probably with a textbook definition)
P-R3	I taught them to think of it (range) as the distance between the starting point and the end point of the data though	**DE**	A descriptive explanation, a textbook descriptive definition of the term which is of level IR3 is part of the 'D'. It suggests that the teacher accepts descriptive definition of terms in the explanation of terms.
	I was referring to the difference between the smallest and the largest value. Coming to the median and the quartiles,	**DE**	A descriptive explanation, a textbook descriptive definition of the term which is of level IR3 is part of the 'D'. It suggests that the teacher accepts descriptive definition of terms in the explanation of terms.

What this table illustrates is that:

- There was only one textbook descriptive explanation which the teacher gave. This implies that the teacher was promoting learners' conceptual development about the term and learners were expected to receive the definition of the term at IR level 3.

- The textbook descriptive explanation was given in lesson 1 indicating it was important at that time for the learners to access that term conceptually. Also implied is that the teacher is the one who decides when the learners should get conceptual understanding of the term.
- The teacher used the mathematical language in explanation; this suggests that the teacher was skilfully developing learners in the use of the language so that they see the importance of the language. This language is the one used to convey mathematical ideas and if learners poorly grasp it, it is believed that it becomes a major source of underachievement in school (Cuevas, 1984). Therefore, the teacher should accompany the mathematics terminology learner access with mathematical language skills for a complete mastering of mathematical concepts/terminology.
- Interview utterances (P-R3) also indicate the use of descriptive explanation when explaining the terms and this suggests that the teacher value them (Gee, 2005) in learner terminology access.

Speaker	**Utterance**	**Code**	**Comment**
L1:3 Teacher	what he has found out is that there is a range there. So range is there,	**ML**	'd' in 'D' –English, a communication tool (Gee, 2005), this suggests that the teacher is using the mathematical language as a communication tool in the explanation of terms.
L1:5 Teacher	saying the range, how do you define the range, what is the range	**ML**	'd' in 'D' –English, a communication tool (Gee, 2005), this suggests that the teacher is using the mathematical language as a communication tool in the explanation of terms.
L1:6 Class	Highest score minus lowest score	**ML**	'd' in 'D' –English, a communication tool (Gee, 2005), this suggests learners were expected to use the mathematical language as a communication tool in the explanation of terms.
L1:11 Nicho	Quartile, it's the lower quartile which is the median of the first half	**ML**	'd' in 'D' –English, a communication tool (Gee, 2005), this suggests learners were expected to use the mathematical language as a communication tool in the explanation of terms.

L1:14 Teacher	What's the abbreviation of the lower quartile	**ML**	'd' in 'D' –English, a communication tool (Gee, 2005), this suggests that the teacher is using the mathematical language as a communication tool in the explanation of terms.
L2:5 Teacher	Eh people I would say (…) you don't say one, two. three you would rather say eleven, twelve, thirteen just to use the correct numbers then, that way helps you to remember this, you then say twenty one, twenty three, okay	**ML**	'd' in 'D' –English, a communication tool (Gee, 2005), this suggests that the teacher insists using the mathematical language as a communication tool in the explanation of terms.
L2:6 Class	Fourteen, fifteen, sixteen, seventeen, eighteen	**ML**	'd' in 'D' –English, a communication tool (Gee, 2005), this suggests learners were expected to use the mathematical language as a communication tool in the explanation of terms.
L2:8 Teacher	How many scores are there?	**ML**	'd' in 'D' –English, a communication tool (Gee, 2005), this suggests that the teacher is using the mathematical language as a communication tool in the explanation of terms.
L2:14 Brenda	Three and four, I look for my lower quartile then I found its twenty three, then my median is twenty three plus twenty four divide by two because lower quartile is also median	**ML**	'd' in 'D' –English, a communication tool (Gee, 2005), this suggests learners were expected to use the mathematical language as a communication tool in the explanation of terms.
L2:117 Teacher	The mean not the median, this is the mean, why is it the mean not the median	**ML**	'd' in 'D' –English, a communication tool (Gee, 2005), this suggests that the teacher is using the mathematical language as a communication tool in the explanation of terms.

What this table illustrates is:

- The use of the mathematical language in the explanation of terms.
- The teacher used the mathematical language in explanation; this suggests that the teacher was skilfully developing learners in the use of the language so that they see the importance of the language. This language is the one used to convey mathematical ideas and if learners poorly grasp it, it is believed that it becomes a major source of underachievement in school (Cuevas, 1984). Therefore, the teacher should accompany the mathematics terminology learner access with mathematical language skills for a complete mastering of mathematical concepts/terminology.

Speaker	**Utterance**	**Code**	**Comment**
L1:62 Learner	*Sithole imedian, le ephakhati khuphela forty six* {We have found the median, the only one in the middle is forty six}	**NML**	'd' (Gee, 2005) in 'D' – non-mathematical language, this suggests that learners are allowed to communicate in their own languages at times
L1:91 Brenda	*Hasifuni lawa mafour four asiarrange ne* {we don't like these four fours let us arrange them, ok}	**NML**	'd' (Gee, 2005) in 'D' – non-mathematical language, this suggests that learners are allowed to communicate in their own languages at times
L2:2 Thabo	*ngu number bani lapha* {what is the number here}	**NML**	'd' (Gee, 2005) in 'D' – non-mathematical language, this suggests that learners are allowed to communicate in their own languages at times
L2:3 Class	*Kunye, kubili, kubili* {one, two two}	**NML**	'd' (Gee, 2005) in 'D' – non-mathematical language, this suggests that learners are allowed to communicate in their own languages at times
L2:4 Thabo	*Kuthathu, kuthathu, kuthathu, kuthathu, Kuthathu, kune, kuhlanu* {three, three, three, three, three, four, five}}[writing on the board]	**NML**	'd' (Gee, 2005) in 'D' – non-mathematical language, this suggests that learners are allowed to communicate in their own languages at times

L2:7 Nicole	*Ehe wena awuyibalanga* {you, you did not write it}	**NML**	'd' (Gee, 2005) in 'D' – non-mathematical language, this suggests that learners are allowed to communicate in their own languages at times
L2:18 Nicole	*Unamanga, ayisi,* [You are lying, it's not]	**NML**	'd' (Gee, 2005) in 'D' – non-mathematical language, this suggests that learners are allowed to communicate in their own languages at times
L2:89 Teacher	Where is your textbook, please bring the textbook to class all the time,	**NML**	'd' (Gee, 2005) in 'D' – non-mathematical language, this suggests that learners are allowed to communicate in their own languages at times
L2:119 Teacher	*Yo yo yoo* {no,no,no}	**NML**	'd' (Gee, 2005) in 'D' – non-mathematical language, this suggests that the teacher at times communicates with the learners in a non-mathematical language.

What this table illustrates is:

- The use of the non-mathematical language in the explanation of terms.
- The teacher used both ordinary and mathematical languages in class; this suggests the inter-change of these languages by the teacher with the intention to cater for multilingualism in class.
- The allowed learners to use their home language mostly when discussing in their groups sharing ideas.

Speaker	**Utterance**	**Code**	**Comment**
L1:11 Nicho	Quartile, it's the lower quartile which is the median of the first half	**TDD IR3**	A descriptive response, a textbook descriptive definition of the term which is of level IR3 is part of the 'D', this is what Nicho gave and the teacher acknowledges it by reminding learners of it being the lower quartile of the data.
L1:23 Learner	The number that divides that divides the data into two parts, right [asking if	**TDD IR3**	A descriptive response, a textbook descriptive definition of the term which is of level IR3 is part of the 'D'; it suggests that the teacher accepts descriptive explanation of the term because gave it and she acknowledges it "Right". Learners, as a practice, confirm with the teacher if

	he was right]		their responses are correct.
L1:24 Teacher	it is the middle value of that data when the data is arranged in order of size, right,	**TDD IR3**	A descriptive explanation, a textbook descriptive definition of the term which is of level IR3 is part of the 'D'. It suggests that the teacher accepts descriptive definition in the explanation of terms; this is indicated by the teacher's remoulding of learner's answer giving a textbook descriptive definition. The teacher re-voices the definition (probably with a textbook definition)

What this table illustrates is:

- There are two attempts of textbook descriptive definition from the learners and one teacher's re-moulding of learner's definition. This implies that the teacher promoted learners' conceptual development about the terms and the learners received the definitions of the terms at IR level 3.
- The textbook descriptive definitions were given in lesson 1; this indicates that the teacher put more emphasis on descriptive definitions in lesson 1 than in 2. Also implied is that lesson 1 was a crucial lesson for the terms learners needed to understand them in the initial stages of engaging with the terms.
- The learners used the mathematical language in their descriptive definitions; this suggests that learners were putting mathematical language skills taught by the teacher into practice, hence understanding of the terminology.
- Textbook descriptive definitions call for a descriptive conceptual understanding. Setati (2005b) referred to this as a conceptual Discourse, this is where mathematical concepts are discussed or described, and therefore, the teacher was providing descriptive understanding of terms. Essien (2011) understands descriptive explanations as conceptual explanations, and these promote conceptual understanding of the mathematical terms in learners (Kilpatrick et al., 2001), hence relational understanding of those terms (Skemp, 1976). This implies that learners are also given an opportunity to access the terminology conceptually.

Speaker	**Utterance**	**Code**	**Comment**
L1:34 Teacher	they said find the range using the formula that the range is equal to highest score minus...	**TPD IR2**	This is indicative of 'D', i.e. textbook procedures. It suggests that the teacher uses the textbook procedures in getting the meaning of terms in the explanation of the terms. This sound

			so because the teacher is giving a procedural way of getting then range by saying "range is equal to highest score minus..."
L1:45 Teacher	Quickly calculate it	**TPD IR2**	This is indicative of 'D', i.e. textbook procedures. It suggests that the teacher uses the textbook procedures in getting the meaning of terms (Ball, 1990), it also suggests that the teacher is practicing a Calculational Discourse (Setati, 2005b) in the explanation of the terms.
L1:55 Teacher	Eighty two minus the lowest...	**TPD IR2**	This is indicative of 'D', i.e. textbook procedures. It suggests that the teacher uses the textbook procedures in getting the meaning of terms in the explanation of the terms.
L2:14 Brenda	Three and four, I look for my lower quartile then I found its twenty three, then my median is twenty three plus twenty four divide by two because lower quartile is also median	**TPD IR2**	This is indicative of 'D', i.e. textbook procedures. It suggests that the teacher uses the textbook procedures in getting the meaning of terms in the explanation of the terms.
L2:16 Brenda	I find the median of the whole numbers, then I find the median of the half because median of the lower is the lower quartile	**TPD IR2**	This is indicative of 'D', i.e. textbook procedures. It suggests that the teacher uses the textbook procedures in getting the meaning of terms in the explanation of the terms.
L2:20 Joy	I divided the positive two by two…	**TPD IR2**	This is indicative of 'D', i.e. textbook procedures. It suggests that the teacher uses the textbook procedures in getting the meaning of terms in the explanation of the terms.
L2:24 Joy	We divide our data into two, then we calculate the median	**TPD**	This is indicative of 'D', i.e. textbook procedures. It suggests that the teacher uses the textbook procedures in getting the

		IR2	meaning of terms in the explanation of the terms.
L2:33 Peter	therefore you take two numbers to get your middle number and then add them and divide by two and its going to be sixteen plus fifteen then you get thirty one divide by two which is equal to fifteen coma five and that means end quartile	**TPD IR2**	This is indicative of ‘D’, i.e. textbook procedures. It suggests that the teacher uses the textbook procedures in getting the meaning of terms in the explanation of the terms. She gives a procedural explanation while looking into the textbook.
L2:83 Teacher	just calculate your mean, median, whatever is asked there, okay	**TPD IR2**	This is indicative of ‘D’, i.e. textbook procedures. It suggests that the teacher uses the textbook procedures in getting the meaning of terms (Ball, 1990), it also suggests that the teacher is practicing a Calculational Discourse (Setati, 2005b) in the explanation of the terms.
L2:109 Teacher	you must write the formula median is equals to (-), you write the two numbers and	**TPD IR2**	This is indicative of ‘D’, i.e. textbook procedures. It suggests that the teacher uses the textbook procedures in getting the meaning of terms in the explanation of the terms.
L2:114 Mike	X bar is equal to the sum of...	**TPD IR2**	It is an indication of ‘D’ practice and it suggests a ‘valued’ procedural response from a learner and the teacher accepts the meaning of the term in value form which is obtained from a procedural way of finding meanings of terms.
P-R3	The words mean, mode and range were understood quite easily and they were easy to find than median and quartiles.	**TPD IR2**	This is indicative of ‘D’, i.e. textbook procedures. It suggests that the teacher uses the textbook procedures in getting the meaning of terms in the explanation of the terms.

	I think they understood the first three because they are easy to calculate…for example mean is what they used to call average, mode being what appears most in their data	**TPD IR2**	This is indicative of 'D', i.e. textbook procedures. It suggests that the teacher uses the textbook procedures in getting the meaning of terms in the explanation of the terms.
	when the number of numbers is even they sometimes get a value which is not in their data so they get confused but when the number of numbers is odd the median is easy to pick because it appears to be the middle number and for the quartiles as percentiles… normally they want to get the percentages as (25%, 50%, 75%) to show that they are in quarters,	**TPD IR2**	This is indicative of 'D', i.e. textbook procedures. It suggests that the teacher uses the textbook procedures in getting the meaning of terms in the explanation of the terms.

What this table illustrates is that:

- There were textbook procedural definitions which the teacher and the learners gave for the terms. This implies that the teacher accepts procedural definitions and also explains the terms procedurally. It suggests that learners' access mathematical terminology procedurally, therefore, the teacher socialises learners in the explanation of terms through a calculational Discourse (Setati, 2005b) which Essien (2011) referred to as a procedural Discourse. In the Definition Discourse, I define Calculational Discourse or procedural Discourse as when methods of calculating or procedures of finding what the term stands for in mathematics are used to explain the term.
- Also implied is that TPD will only enable learners to access definition of terms in the IR2 level.

Speaker	**Utterance**	**Code**	**Comment**
L1:11 Nicho	Quartile, it's the lower quartile which is the median of the first half	**DR**	A descriptive response, a textbook descriptive definition of the term which is of level IR3 is part of the 'D', this is what Nicho gave and the teacher acknowledges it by reminding learners of it being the lower quartile of the data.

L1:23 Learner	The number that divides that divides the data into two parts, right [asking if he was right]	**DR**	A descriptive response, a textbook descriptive definition of the term which is of level IR3 is part of the 'D'; it suggests that the teacher accepts descriptive explanation of the term because gave it and she acknowledges it "Right". Learners, as a practice, confirm with the teacher if their responses are correct.

What this table illustrates is that:

- There two attempts of textbook descriptive responses from the learners. This implies that the teacher promoted learners' conceptual development about the terms and the learners received the definitions of the terms at IR level 3.
- The textbook descriptive responses were given in lesson 1; this indicates that the teacher put more emphasis on descriptive explanations in lesson 1 than in 2. Also implied is that lesson 1 was a crucial lesson for the terms learners needed to understand them in the initial stages of engaging with the terms.
- The learners used the mathematical language in their descriptive responses; this suggests that learners were putting mathematical language skills taught by the teacher into practice, hence understanding of the terminology.
- The two attempts are in lines L1:11 and L1:23 and the teacher asked descriptive questions in lines L1:10 and L1:22 this implies that the descriptive responses were given after descriptive questions, therefore, only two of the descriptive questions were followed by descriptive explanations while the rest might have been answered procedurally. For example, there are three DQs which were followed by either a PE or a PR i.e. DQ (L1:43) was followed by PR (L1:46), DQ (L1:71) was followed by PE (L1:72) DQ and (L2:117) was followed by PR (L2:118) see transcripts.

Speaker	**Utterance**	**Code**	**Comment**
L1:1 Teacher	…and sat quietly in groups facing the board waiting for the teacher's opening instruction of the lesson.	**CIT1**	'D' – sitting in groups facing the board, suggests teacher's classroom interactive pattern, CIT1, (Scott et al., 2006), she approves of when teaching mathematical terms. Learners were observed seated in groups facing to the front.
	…and you were working in groups so each	**CIT1**	'D' – group work, it suggests teacher's classroom interactive pattern, CIT1 when teaching mathematical terms (Scott et al., 2006). This is so because

	group should tell us what they did, ok.		the teacher gave learners work to do in groups and now each group is to report back.
L1:36 Teacher	I want you in your groups (...) on the data	**CIT1**	'D' – group work, it suggests teacher's classroom interactive pattern which creates and engages learners in sound CIT1 pattern of interaction when teaching mathematical terms (Scott et al., 2006)
L1:38 Teacher	in your groups	**CIT1**	'D' – group work, it suggests teacher's classroom interactive pattern which creates and engages learners in sound CIT1 pattern of interaction when teaching mathematical terms (Scott et al., 2006)
L1:42 Teacher	why are you five in one group [insisting on four in a group]	**CIT1**	'D' – sitting in groups facing the board, suggests teacher's classroom sitting arrangement and the interactive pattern, CIT1, (Scott et al., 2006), she approves of when teaching mathematical terms.
L1:59 Teacher	okay there is a hand [going to one of the groups],	**CIT1**	'D' – group work, it suggests teacher's classroom interactive pattern which creates and engages learners in sound CIT1 pattern of interaction when teaching mathematical terms (Scott et al., 2006)
L1:69 Teacher	are you working as a whole group	**CIT1**	'D' – group work, it suggests teacher's classroom interactive pattern which creates and engages learners in sound CIT1 pattern of interaction when teaching mathematical terms (Scott et al., 2006)
L1:71 Teacher	you are not working in a group, you must discuss as a group,	**CIT1**	'D' – group work, it suggests teacher's classroom interactive pattern which creates and engages learners in sound CIT1 pattern of interaction when teaching mathematical terms (Scott et al., 2006)
L1:75	or we want sixty seven and sixty two, right let's	**CIT1**	'D' – group work, it suggests teacher's classroom interactive pattern which

Teacher	discuss in groups, two minutes		creates and engages learners in sound CIT1 pattern of interaction when teaching mathematical terms (Scott et al., 2006)
L1:77 Teacher	are you working as a group, you must work as a group, so discuss,	**CIT1**	'D' – group work, it suggests teacher's classroom interactive pattern which creates and engages learners in sound CIT1 pattern of interaction when teaching mathematical terms (Scott et al., 2006)
L1:86 Teacher	Right, any group which have done the stem and leaf	**CIT1**	'D' – group work, it suggests teacher's classroom interactive pattern which creates and engages learners in sound CIT1 pattern of interaction when teaching mathematical terms (Scott et al., 2006)
L2:1 Teacher	[The class monitor had collected and handed out learners' marked group work just before the lesson had started.	**CIT1**	'D' – group work, it suggests teacher's classroom interactive pattern which creates and engages learners in sound CIT1 pattern of interaction when teaching mathematical terms (Scott et al., 2006)
	Which group can present the stem and leaf	**CIT1**	'D' – group work, it suggests teacher's classroom interactive pattern which creates and engages learners in sound CIT1 pattern of interaction when teaching mathematical terms (Scott et al., 2006)
L2:53 Teacher	which group?	**CIT1**	'D' – group work, it suggests teacher's classroom interactive pattern which creates and engages learners in sound CIT1 pattern of interaction when teaching mathematical terms (Scott et al., 2006)
L2:55 Teacher	Which group, you, right okay let's look at what Brenda has drawn there,	**CIT1**	'D' – group work, it suggests teacher's classroom interactive pattern which creates and engages learners in sound CIT1 pattern of interaction when teaching mathematical terms (Scott et al., 2006)
L2:63	next group, they are fine, you are also fine, I	**CIT1**	'D' – group work, it suggests teacher's classroom interactive pattern which

Teacher	expect everyone to be drawing, people remember I told you		creates and engages learners in sound CIT1 pattern of interaction when teaching mathematical terms (Scott et al., 2006)
L2:73 Teacher	in your groups	**CIT1**	'D' – group work, it suggests teacher's classroom interactive pattern which creates and engages learners in sound CIT1 pattern of interaction when teaching mathematical terms (Scott et al., 2006)
L4:1 Teacher	The teacher greeted the learners and ordered them to pull out their group past exam question papers and asked them to answer certain questions	**CIT1**	'D' – group work, it suggests teacher's classroom interactive pattern which creates and engages learners in sound CIT1 pattern of interaction when teaching mathematical terms (Scott et al., 2006)
	after you have discussed with people in your group	**CIT1**	'D' – group work, it suggests teacher's classroom interactive pattern which creates and engages learners in sound CIT1 pattern of interaction when teaching mathematical terms (Scott et al., 2006)
L4:3 Teacher	Are you discussing with your group? [leaving the class for a meeting]	**CIT1**	'D' – group work, it suggests teacher's classroom interactive pattern which creates and engages learners in sound CIT1 pattern of interaction when teaching mathematical terms (Scott et al., 2006)
P-R4	I send them in their groups, and these are permanent groups in that class,	**CIT1**	'D' – group work, it suggests teacher's classroom interactive pattern which creates and engages learners in sound CIT1 pattern of interaction when teaching mathematical terms (Scott et al., 2006)
P-R7	I find group work and report back working well for me, as you just saw in most lessons,	**CIT1**	'D' – group work, it suggests teacher's classroom interactive pattern which creates and engages learners in sound CIT1 pattern of interaction when teaching mathematical terms (Scott et al., 2006)

What this table illustrates is that:

- The teacher was addressing learners while in groups not individually. This implies the teacher's classroom interactive pattern (CIT1) (Scott et al., 2006). Also implied is that the teacher uses this pattern to create and engage learners in a sound participatory interaction when teaching mathematical terms.
- Because the teacher was emphasising on working in groups she used ordinary language in almost all the utterances (except for L2:1), this suggests that on social grounds the teacher uses ordinary language while in the term explanation she uses the mathematical language as was shown in many case where she was explaining the terms (see transcript).
- In the interview the teacher indicated that the groups are permanent and they work effectively for her, this implies that the teacher's main classroom interactive pattern is teacher-group interaction. It also suggests teacher's authoritative communication approach to the teaching of terms and gives platform to dialogic communication between teacher and learners (Scott et al, 2006).

Speaker	**Utterance**	**Code**	**Comment**
L1:51 Teacher	people did we arrange from the highest to the lowest,	**CIT2**	A form of interaction in the 'D' which suggests that the teacher interacts with the whole class other than groups i.e. whole-class interaction (Scott et al., 2006)
L1:96 Teacher	you are supposed to do stem and leaf for number three, (...) you are rectifying number two	**CIT2**	A form of interaction in the 'D' which suggests that the teacher interacts with the whole class other than groups i.e. whole-class interaction (Scott et al., 2006)
L2:39 Teacher	Who wants to come and do the range for us,	**CIT2**	A form of interaction in the 'D' which suggests that the teacher interacts with the whole class other than groups i.e. whole-class interaction (Scott et al., 2006)
L2:49 Teacher	Ooh you have done everything, right, now people any problems with other questions, did you encounter any?	**CIT2**	A form of interaction in the 'D' which suggests that the teacher interacts with the whole class other than groups i.e. whole-class interaction (Scott et al., 2006)

L2:57 Teacher	right, so people try and draw it because most of you didn't draw it, okay I'm going to give you some five minutes to draw, but now people what we should do *ne* {ok} eeh try and use a scale	**CIT2**	A form of interaction in the 'D' which suggests that the teacher interacts with the whole class other than groups i.e. whole-class interaction (Scott et al., 2006
L2:59 Teacher	people you must use a ruler	**CIT2**	A form of interaction in the 'D' which suggests that the teacher interacts with the whole class other than groups i.e. whole-class interaction (Scott et al., 2006
L2:71 Teacher	So please people just go through the symmetrical data, eeh all of you today after you have drawn your box and whisker	**CIT2**	A form of interaction in the 'D' which suggests that the teacher interacts with the whole class other than groups i.e. whole-class interaction (Scott et al., 2006)

What this table illustrates is that:

- The teacher was addressing learners as 'people'. This implies teacher's other classroom interactive pattern (CIT2) (Scott et al., 2006). Also implied is that the teacher uses this pattern to create and engage learners in a sound teacher-whole class interaction using it as an alternate pattern to group interaction so as to avoid creating a monotony of one type interactive pattern in learners.
- The teacher used both ordinary and mathematical languages in addressing the learners; this suggests that the teacher inter-changes these languages with an intention to cater for multilingualism.

Speaker	**Utterance**	**Code**	**Comment**
L2:35 Peter	Lower quartile	**CIT4**	'D' – Learner-learner interaction, learner interacting with another learner suggests a practice teacher allows in class.

What this table illustrates is that:

- A learner was interaction with another learner (see transcript). This implies teacher's other classroom interactive pattern (CIT4) (Scott et al., 2006) used to alternate group interaction so as to avoid creating a monotony of one type interactive pattern in learners.

Speaker	Utterance	Code	Comment
L2:3 Class	*Kunye, kubili, kubili* {one, two two}	**CIT5**	'D' - Learner-class interaction, learner interacting with the class suggests a practice teacher allows in class
L2:16 Brenda	I find the median of the whole numbers, then I find the median of the half because median of the lower is the lower quartile	**CIT5**	'D' – Learner-class interaction, learner interacting with the class suggests a practice teacher allows in class

What this table illustrates is that:

- A learner was interaction with the class (see transcript). This implies teacher's other classroom interactive pattern (CIT5) (Scott et al., 2006) used to alternate group interaction so as to avoid creating a monotony of one type interactive pattern in learners.

Appendix F: Codes used in the Analysis

Participant's communicative approaches	**AC -** Acknowledging learners' contributions **Art -** Use of artefacts **BB -** Blurting out behaviour **BWRT -** Learners write in their books **CB -** Clean chalkboard **CC -** Class control **CL -** Calling out learner's name **CLW -** Checking learners' work **ER -** Encouraging learners to read **FC -** Front of class position **FI -** Free interaction **FK -** Formal knowledge **GSB -** Group sitting **HW -** Home work **IJ -** Idea justification **IK -** Informal knowledge **IL -** Teacher instructing learners **INCS -** Incomplete statements **LCB -** Learners use the board **PK -** Prior knowledge **RK -** Recapping previous knowledge **SD -** Summing-up class discussions **TB -** Textbook use **UR -** Unison response **VT -** Verbalising the term **WTB -** Term written on the board **BR -** Building on learners' ideas

	CI - Considers learner ideas **E -** Using expressions **G -** Using gestures **GD -** Group discussions **HC -** Hints and clues **LQ -** Leading questions **PP -** Paraphrasing learners' responses **QR -** Questions for learners to respond **RFQ -** responses used for further questions **R -** Revisiting ideas **RCW -** Referring to chalkboard work **RV -** Re-voicing learners' responses **WLI -** Writing learners' ideas on the board **AE -** Adding some explanation to learners' contributions **RMD -** Re-moulding learners' definitions **PLQ -** Prodding learners **DM -** Differentiating meanings **DS -** Different sources of definitions **PQ -** Procedural questions **PE -** Procedural explanation **PR -** Procedural response **F -** Formula **DQ -** Descriptive question **DE -** Descriptive explanation **DR -** Descriptive response
Classroom interactions	**CIT1 -** Interacting with groups **CIT2 -** Interacting with the whole class **CIT4 -** Interacting with each other **CIT5 -** Interacting with the class
language-in-use	**ML -** Mathematical language

	NML - Non-mathematical language
Participant’s legitimised definitions	**TDD-** textbook descriptive definition **TPD-** textbook procedural definition
Participant’s source of definitions	**STB -** Classroom textbook as a source of definitions **TB –** Using textbook
Participant’s level of response	**TPD, IR2 -** Textbook procedural definition, interpretive response level 2 **TDD, IR3 -** Textbook descriptive definition, interpretive response level 3
Participant’s teaching strategies	**QAS -** Question and answer **GWS -** group work

Appendix G: Codes Frequency Tables

The table below shows the language count distribution in the class.

	Lesson 1		**Lesson 2**		**Lesson 4**		**Interview**	
	ML	**NML**	**ML**	**NML**	**ML**	**NML**	**ML**	**NML**
Teacher utterance	Every time	Nil	Every time	1	Every time	Nil	Every time	Nil
Learner utterance	Most times	2	Most times	5	Every time	Nil	Most times	1
Total	**Most times**	**Least times**	**Most times**	**6**	**Every time**	**Nil**	**Most times**	**Least times**

The table below shows teacher and learners' practice count in the class
T - Teacher
L – Learners

Interactive/athoritative presentation (IAP) category	**Code**	**Lesson 1**		**Lesson 2**		**Lesson 4**		**Interview**	**Total**
		T	**L**	**T**	**L**	**T**	**L**	**T**	
Acknowledgement	**AC**	11	-	8	-	0	-	-	**19**
Artefacts	**Art**	0	0	1	1	0	0	3	**5**
Blurting Behaviour	**BB**	-	4	-	12	-	0	-	**16**

Insisting Writing Work in Books	**BWRT**	7	-	10	-	0	-	1	**18**
Teacher Chalkboard use	**CB**	1	-	0	-	0	-	0	**1**
Class Control	**CC**	1	-	4	-	0	-	0	**5**
Call Learner Name	**CL**	2	-	9	-	0	-	0	**11**
Check Learner's Work	**CLW**	6	-	3	-	0	-	0	**9**
Encourages Reading	**ER**	1	-	2	-	0	-	3	**6**
Front of Class	**FC**	1	-	1	-	0	-	-	**2**
Free Interaction	**FI**	-	0	-	0	-	0	1	**1**
Formal Knowledge	**FK**	All time	most	All time	most	All time	most	All time	**Most times**
Sitting in Groups facing the Board	**GSB**	1	-	1	-	1	-	1	**4**
Home Work	**HW**	1	-	0	-	0	-	2	**3**
Teacher ask for Idea Justification	**IJ**	1	-	2	-	0	-	0	**3**
Informal Knowledge	**IK**	0	0	0	0	0	0	2	**2**
Instructs Learners	**IL**	8	-	8	-	2	-	2	**20**
Incomplete Sentences	**INCS**	7	-	13	-	0	-	-	**20**

Learner use Chalkboard	**LCB**	-	0	-	2	-	0	-	**2**
Prior Knowledge	**PK**	0	-	0	-	0	-	2	**2**
Recap Knowledge	**RK**	0	-	1	-	0	-	1	**2**
Sum-up Discussions	**SD**	0	-	1	-	0	-	1	**2**
Textbook Use	**TB**	3	-	4	-	0	-	2	**9**
Unison Response	**UR**	-	22	-	10	-	2	-	**34**
Verbalise term	**VT**	1	-	0	-	0	-	1	**2**
Whole-class facing Board Strategy	**WCB**	0	-	0	-	0	-	0	**0**
Writes Term on Board	**WTB**	1	-	0	-	0	-	6	**7**
Interactive/authoritative (IA) category									
Builds on Response	**BR**	0	-	2	-	0	-	1	**3**
Considers learner Contributions	**CI**	1	-	0	-	0	-	0	**1**
Expressions	**E**	3	0	0	0	0	0	1	**4**
Gestures	**G**	7	0	9	3	0	0	-	**19**
Group Discussions	**GD**	4	-	1	-	2	-	1	**8**

Hints and Clues	**HC**	4	-	2	-	0	-	0	**6**
Long Exchanges	**LE**	most	-	most	-	0	-	-	**most**
Leads Learners	**LL**	most		most		most	-	most	**most**
Leading Questions	**LQ**	2	-	0	-	0	-	0	**2**
Paraphrases	**PP**	1	-	0	-	0	-	0	**1**
Questions for Response	**QR**	26	-	14	-	0	-	4	**44**
Use Response for Further Questions	**RFQ**	3	-	2	-	0	-	1	**6**
Revisits	**R**	1	-	0	-	0	-	0	**1**
Refers to Chalkboard Work	**RCW**	2	0	4	1	0	0	0	**7**
Re-voices	**RV**	11	-	9	-	0	-	-	**20**
Writes learner ideas on board	**WLI**	3	-	1	-	0	-	-	**4**
Adds Explanation	**AE**	2	-	2	-	0	-	-	**4**
Conventional Definition	**CD**	all	all	all	all	-	-	all	**All**
Prodding Leading Question	**PLQ**	3	-	0	-	0	-	-	**3**
Differentiating Meanings	**DM**	2	-	1	-	0	-	-	**3**
Re-mould Definition	**RMD**	2	-	2	-	0	-	-	**4**

The table below shows the count of teacher's strategies of teaching

Teaching strategy category	**Code**	**Lesson 1**	**Lesson 2**	**Lesson 4**	**Interview**	**Total**
Question and answer	**QAS**	19	9	0	4	**32**
Group work	**GWS**	12	6	3	2	**23**
Whole class	**WCS**	6	7	0	0	**13**
Class Discussion Strategy	**CDS**	0	0	0	0	**0**

The table below shows the count of teacher's sources of definition

Sources of definition category	**Code**	**Lesson 1**	**Lesson 2**	**Lesson 4**	**Interview**	**Total**
Where the textbook was used	**TB**	3	4	0	2	**9**
Source Textbook	**STB**	2	3	0	5	**10**
Where different sources were used or mentioned	**DS**	0	1	0	2	**3**
Where the dictionary was used	**D**	0	0	0	0	**0**

Level of response (IR2) category	**Code**	**Lesson 1**		**Lesson 2**		**Lesson 4**		**Interview**	**Total**
		T	**L**	**T**	**L**	**T**	**L**	**T**	

Procedural Question	**PQ**	13	0	9	0	0	0	1	**23**
Procedural Explanation	**PE**	4	5	4	10	0	0	1	**24**
Procedural Response	**PR**	-	9	-	8	-	0	-	**17**
Reads Procedural Definition	**RPD**	0	0	0	0	0	0	0	**0**
Formula	**F**	1	0	4	3	0	0	0	**8**

Level of response (IR3) category	**Code**	**Lesson 1**		**Lesson 2**		**Lesson 4**		**Interview**	**Total**
		T	**L**	**T**	**L**	**T**	**L**	**T**	
Descriptive Question	**DQ**	8	0	1	0	0	0	-	**9**
Descriptive Explanation	**DE**	1	-	0	-	0	-	2	**3**
Descriptive Response	**DR**	-	2	-	0	-	0	-	**2**
Reads Descriptive Definition	**RDD**	0	0	0	0	0	0	0	**0**

Classroom Interactive Talk (CIT) category	**Code**	**Lesson 1**	**Lesson 2**	**Lesson 4**	**Interview**	**Total**
Interacting with groups	**CIT1**	12	6	3	2	**23**

Interacting with whole class	**CIT2**	6	7	0	0	**13**
Interacting with individuals	**CIT3**	0	0	0	0	**0**
Learners interacting with each other	**CIT4**	0	1	0	0	**1**
Learner interacting with the class	**CIT5**	0	2	0	0	**2**
Learner leading the teacher	**CIT6**	0	0	0	0	**0**