# CHAPTER 1: INTRODUCTION

Many teachers in South Africa are still caught in the ongoing cycle of generations of inferior education during the Apartheid years. Verwoerd stated that there was no reason to teach mathematics to black people because it would make them dissatisfied with their position in life, which was to serve white people.

> The school must equip the Bantu to meet the demands which the economic life of South Africa will impose on him...... There is no place for him in the European community above the level of certain forms of labour. Within his own community, however, all doors are open. Until now he has been subject to a school system which drew him away from his own community and misled him by showing him the green pastures of European society in which he is not allowed to graze.... What is the use of teaching a Bantu child mathematics when it cannot use it in practice... That is absurd.....
>
> Hendrik Verwoerd addressing the Senate in June 1954 about government policy on Black Education in South Africa.

Consequently, many mathematics teachers, through no fault of their own, are under qualified and/or poorly trained. Often, primary school teachers are teaching mathematics despite their own dislike, disinterest or fear of the subject resulting in poor development of basic skills and understanding in the primary school. This has a serious ripple effect on learners' ability to develop the required mathematical understandings needed for successful participation in mathematics at high school and tertiary level. Many parents are equally unable to assist their children with mathematics because of their own histories with the subject.

This situation has resulted in teaching styles in many schools which still favour rote- learning (Setati, 1998; Taylor & Vinjevold, 1999). The fact that outdated techniques are still prevalent, is not peculiar to South Africa. Staples (2007) talks of the "staying power of traditional models" (p.3) and quotes Boaler (2003) to explain that it is due to the "underdevelopment of understanding (amongst teachers) of the nature of the practices (reform practices) and the roles required of teachers and students to enact these practices successfully" (p. 162). Those communities which are using reform practices in the classroom enable "positive identity development" (Boaler & Greeno, 2000, p.188) and involve beliefs about mathematics, which, according to Schoenfeld (1988, 1992), are closer to those of mathematicians than those of students in traditional classrooms. Gravemeier (1997), cited in Forman and Ansell (2001, p.137) speaks of the tension between traditional and reform style instruction. He presents the traditional model as "aimed at fostering speed and accuracy in the use of algorithms" and the reform model as "aimed at fostering conceptual understanding and complex problem solving" which is achieved through conjecturing, reasoning and justification by the learners for their thinking. In arguing for the take up of the reform model as a way to make mathematics meaningful for learners, Gravemeier (ibid) suggests that the two approaches are irreconcilable. Brodie (2010) argues that it is not an either- or situation for many teachers. According to her research, teachers are using both models, moving from the one to the other for different aspects of a lesson. It is my view that teachers who have been exposed to the reform model, might use the reform model for the mathematics which they understand better but will use the traditional model in sections of work for which they have less conceptual understanding themselves. My view links to findings reported by Taylor & Vinjevold (1999) that "poor conceptual knowledge is accompanied by a superficial understanding of what makes for good teaching and learning. The result is teacher-centred practices and very superficial engagement with "pupils' conceptual development" (p.143). This suggests that traditional teacher-centred teaching allows the teacher to maintain control of the discourse and keep it within the bounds of their own knowledge. If we want teachers to use the reform model in a consistent manner, the importance of teacher training which engages teachers in high level conceptual development themselves, cannot be overestimated. Kilpatrick et al., (2001) have helped us to move away from seeing the two models as dichotomous. They have helped us to value speed and accuracy in the use of algorithms as just one of five strands of mathematical proficiency. The other strands are more closely aligned to the reform model which aims for conceptual understanding through practices such as reasoning and justification. Similarly, Setati (2005) found that teachers use English for procedural teaching and switch to home language to help learners really understand what they're doing.

Another way in which the traditional style of teaching has been challenged is in the starting point for teaching. In traditional classrooms, the teacher chooses what to teach and presents it to the learners in a transmission mode. This teacher centred style of teaching has been challenged by the reform model in which lessons are expected to be learner centred. This can be interpreted in various ways but comes back each time to the learner as the starting point. Learners come to school with their own understandings and interpretations of the world which are mostly ignored by teachers. A learner centred teaching style involves helping learners shift their own understandings to those required by the curriculum. Honing in on the classroom mathematical discourse which is the centre of my study, learners come to school with informal ways of expressing what they understand about the world, about numbers, about life etc..... The teacher can assist the learner to move from his/her informal ways of talking to the more formal ways of talking required by the curriculum and the discipline. A learner may use informal language to describe both the products and processes of mathematics, e.g. she may describe addition as "plussing" or she may make the following conjecture: "the numbers which go into 24 without anything left over" are less than "the numbers which go into 36 without anything left over". Clearly, these informal expressions indicate that the learner understands the concepts but does not yet have the required mathematical register (Halliday, 1978, cited in Setati & Adler, 2001). The teacher can then assist the learner to acquire the correct mathematical register over time.

The National Curriculum Statement (NCS) (2002) (the version that was in place during the period of this study) aligns itself in many ways with reform style teaching as stated in the National Council of Teachers of Mathematics (NCTM) (1989). Examples of this alignment are found in the following sections of the NCS. In the Definition of the NCS, it suggests that Mathematics is a culturally loaded human activity, developed and contested over time through both language and symbols by social interaction and therefore is open to change and new insights. The section on Purpose of the NCS, emphasises the development of competence to deal with "any mathematical situation without fear" (p.4) In the section entitled Scope of the NCS, it says that learners will work towards being able to use mathematical process skills such as making conjectures, proving assertions, generalising and refuting. These skills are developed alongside an awareness of human rights and using mathematics to develop a critical understanding of how the world works. Communication is an essential tool for the achievement of these process skills. In the Teacher's guide for the Development of Learning Programmes, it says:

> Communication is one of the critical skills to be developed throughout the GET phase. Learning Programmes need to ensure ample opportunities for learners to practice communicating.
>
> - Talk, read and write about mathematics with understanding
> - Listen to and interpret discussions about and involving mathematics (p.29).

Making conjectures, explaining one's reasoning to others and justifying one's ideas are the ways in which learners can communicate with each other and/or during whole class discussions with the teacher.

This approach stated both in the NCTM (1989) standards and the NCS (2002), underpins the focus of my study which is the examination of a communication practice known as revoicing. Revoicing is a practice which is used during collaborative whole class discussion and is situated within the reform model. Moschkovich (1999) raises the question "What can a teacher do to facilitate student participation in a mathematical discussion? How can a teacher support students in speaking mathematically?" (p.14) In answer to her question, she suggests revoicing as a key way to achieve this type of communication.

O'Connor & Michaels (1993, 1996) who introduced the term revoicing to the mathematics education research field, state that revoicing involves repeating or rephrasing of a learner's idea, by either the teacher or another learner. This keeps the idea on the table so that learners can engage with it at their own pace and deepen their understanding. They also identify revoicing as a mechanism for positioning a learner's idea in relation to other learners' ideas as well as in relation to the discipline of mathematics. Revoicing is promoted for its role in bringing out the ideas of learners, no matter in which language, how informal, incomplete or misconceived. In so doing, revoicing can assist learners to clarify and transform their ideas into something closer to a formal mathematical way of thinking and expressing. Revoicing can be used to reveal learners' conceptions/ misconceptions and by keeping these in focus in lessons, revoicing opens up the potential for conceptions to be rethought and transformed. Revoicing can be enacted by learners and/or the teacher.

## INTRODUCING MY STUDY

This study is focused on an examination of the types of revoicing practices used by the two teachers in my sample. This examination takes place against a backdrop of both international and local research which views revoicing as a worthwhile practice in the classroom, in helping learners to achieve mathematical understanding. Within a schooling system where English is the preferred language of instruction despite the fact that it is the home language of a small minority of learners, revoicing has been pinpointed as particularly useful. This study is focused on understanding the different types of revoicing practices used in mathematics classrooms today and how they support or constrain opportunities for the appropriation of the required mathematical discourse.

## MY SAMPLE

In my study, both teachers interacted constantly with their learners but neither of the teachers used the home languages of the learners in the classroom. English was the only language which was used. The one teacher, whom I shall call, Bongani, focused on the solving of word problems in all three lessons. At first glance, he appeared to be probing for learners' conceptual understanding. A deeper look suggested that his probing was focused more on the calculational than conceptual understanding..

As my focus is on a particular teaching practice, it was not necessary for the teachers to be teaching the same content. It was therefore not a problem that the second teacher in my study whom I call, Refiloe, was teaching shape and space as well as word problems related to long division.

In my own teaching experience, I have found both division and word problems to be challenging for learners. I have observed grade 5 learners struggle with division at a language level as well as with procedural and conceptual development. E.g. The phrases “divide by” and “divide into” are often used by learners interchangeably. At a procedural level, learners struggle with the long division algorithm when it is taught purely as a procedure. It is at this point that teachers often rely on revoicing in the form of chorusing a memory device “divide, multiply, subtract and bring down” to drill the algorithm. If revoicing is used to develop the conceptual understanding of division, it may help learners overcome their difficulties in this area and prepare them for the more complex understanding required when learning fractions and then rational numbers. Word problems, on the other hand, bring up the language difficulties which learners experience.

## RESEARCH QUESTION

The purpose of my study is to look at revoicing by asking the following question:

> What is the nature and range of revoicing practices used by the teachers in the sample in an effort to open up opportunities for learners to participate in mathematical discourse?

For this study I collected data from two teachers in ex model C schools after the midyear school holidays in 2011. I filmed 3 of each of their lessons, used audiotape to listen to learners’ discussions in their groups and interviewed both the teachers. I drew on situated theory, in particular Lave & Wenger’s (1990) notion of Legitimate Peripheral Participation in order to observe how a teacher was playing the role of expert, revoicing learner utterances in order to support the learner’s appropriation of the mathematical discourse. I also drew on Gee’s (1996) notion of cultural models to explain parent attitudes to language use in the classroom as well as his broad notion of Discourse as it related to interaction and communication practices in the classroom. Setati and Adler (2001) provided a model for viewing appropriation of discourse as it moves from informal spoken discourse to formal spoken and written mathematical discourse in English. Finally, I drew on O’Connor & Michaels (1996) conception of revoicing as a starting point for this study. Brodie’s (2008, 2010) categories of feedback within the traditional interaction style of teachers provided the beginnings of a coding framework for my study which will be explained fully in chapter 2.

## OUTLINE OF THE REST OF THE REPORT

In **chapter 2**, I will introduce my theoretical framework which will provide the broad lens through which I view my study including the importance of all learners having access to participation in mathematical discussions. I introduce the idea of the learner as a language apprentice within the framework of Legitimate Peripheral Participation (Lave & Wenger, 1990). I will also present an additional framework which shows the steps a learner may need to take to get from her informal ways of talking about mathematical ideas in her home language to the discourse required according to changing Government policy. This provides a 2nd lens through which I view my research and impacts on my interpretation of the data.

I will then present a literature review of the practice of revoicing which can be traced back to the 1970's. I will show how revoicing has been identified in classrooms and used in different ways, sometimes to clarify ideas or to position learners in relation to each other, other times to bring out the voices of marginalised learners and their ideas. I will show how revoicing affects the power relationships in the classroom and how it has the potential to give access to English Second Language (ESL) learners to equal participation in mathematical discussion. I will present some findings from the literature which suggest that revoicing is worthy of further study.

The chapter will conclude with the introduction of the coding instrument and a detailed explanation of the codes used in the instrument.

**Chapter 3** will outline my research design. I will provide an explanation and justification for my purposive sample selection and the data collection methods. I will also explain the ways in which I tried to ensure reliability and validity of the results in this study.

In **Chapter 4** I begin with the views of the teachers in my sample based on their interviews which gives us a context for understanding my findings and analysis which follow. My findings using a detailed coding instrument and several excerpts from lessons are then presented. I relate my findings back to the literature, my theoretical basis for my research project as well as the framework which underpins the coding model. I then draw conclusions about the nature and extent that revoicing is used by the teachers in the sample and relate their own explanations about their use or non-use of revoicing to my conclusions.

**Chapter 5** will conclude the research report with a summary of the findings followed by an attempt to draw out the main points for consideration. I will suggest ways to take this line of research forward in the hope of contributing to the development of productive language and discourse practices in South African mathematics classrooms in the near future.

# CHAPTER 2: THEORETICAL FRAMEWORK AND LITERATURE REVIEW

## INTRODUCTION

The focus on the nature and role of communication within mathematics is relatively new. A key driver for this focus was the publication of The National Curriculum and Evaluation Standards for School Mathematics (NCTM) in the USA in 1989. As pointed out in the last chapter, this curriculum placed explicit focus on the processes involved in learning. This, in turn, has led to an enormous amount of research in the United States and internationally into the meaning and application of these standards, particularly in the area of communication (Moschkovich, 1999; Ball, 1991), as well as two handbooks produced by the NCTM on teaching and learning mathematics. According to Moschkovich (1999), the NCTM standards which were later backed by the research of, amongst others, Ball (1991) and Cobb et al., (1993), promote "instructional strategies for orchestrating and supporting mathematical discussions" (p.12). A new body of literature explicitly advocating "learning as participation" in classroom mathematical discourse (Forman, 1996; Lampert & Cobb, 2003, p.239) introduced a line of thinking which shifted away from the acquisition oriented model.

Some important research on communication as learning in South African classrooms has been conducted over the past two decades by Adler (1998, 2001), Setati & Adler (2001) and Setati (1998, 2005, 2008) whose work pays special attention to mathematical thinking in multilingual classrooms as well as the varied possible routes taken by learners when moving from everyday, informal discourse to formal mathematical discourse. Another important South African contribution to this field has been made by Brodie (2007, 2008, 2010) who has focused on "teacher talk" and "interaction patterns" during whole class discussions after learners had worked on tasks with their peers.

This study is underpinned by the view that greater participation in mathematics involves openings to appropriate mathematical discourse. The theoretical frameworks that I draw from will be introduced in the next section.

## THEORETICAL FRAMEWORK/S FOR THIS STUDY

I use the theory of Legitimate Peripheral Participation (LPP) (Lave & Wenger, 1991) as a foundation for my study, collecting and analysing my data in relation to the ways in which teachers used the practice of revoicing to support their learners in appropriating mathematically coherent forms of communication in the mathematics classroom. In the foreword to Situated Learning, a book by Lave and Wenger (1991), Hanks states that LPP is "an interactive process in which the apprentice engages by simultaneously performing in several roles – status subordinate, learning practitioner, sole responsible agent in minor parts of the performance, aspiring expert........" (p.23)

If we apply this idea to a child who joins a school choir, s/he is performing several roles while learning at the same time. She has a subordinate status as a new member, she is a learning practitioner in that she is learning to sing music which may be new to her but she is singing, not just listening. At the same time she is responsible for her part in the whole performance which may be the alto part assisted by other more experienced altos. She may also be an aspiring expert in the sense of wanting to learn to blend her voice to the rest of the singers, be able to hold her part without relying on others, learn to sight read, and ultimately play the role of expert as new singers join the choir.

LPP therefore describes learning as a process of taking part in something and extending your participation until you become a full participant by playing increasingly expert roles. Lave and Wenger remind us that LPP is "not a teaching technique but an analytical viewpoint for understanding learning" (p.40). This viewpoint stands in opposition to the theories of learning which see learning as the acquisition of knowledge.

The theory of LPP does not describe ***what*** learners are expected to participate in, in the mathematics classroom. To clarify this I use Gee's (1996) notion of Discourse. Discourse, in Gee's (ibid) terms which will be explained more fully later, involves "a way of speaking, choice of words which identifies you as part of a group, body language, dress etc.... Discourses, then, are ways of behaving, interacting, valuing, thinking, believing, speaking, and often reading and writing that are accepted as instantiations of particular roles by specific groups of people" (p.viii). This is how the successful learner participates in a classroom. The fuller the participation, the more successful the learner will be.

While I endorse the importance of all the above aspects of Gee's (1996) definition of Discourses, my lens is focused more on the varied attempts by teachers to support gradual development of the accepted ways of talking mathematically. In appropriating this Discourse, the learner becomes a "fuller" participant in the mathematics classroom. In essence, I will be looking at the ways in which teachers communicate to encourage the development of accepted ways of talking mathematically with a particular focus on whole class discussions.

Lave & Wenger (1991) use the term "peripheral" (p.36) as it relates to social power. If it describes a route to participation, then it is empowering and conversely, if it describes the exclusion of individuals from participation, it is disempowering. Use of language in the classroom appears to exemplify the ideas of LPP and Discourse in that the learner who participates in the required Discourse is more empowered than the learner who is unable to participate due to cognitive, emotional or language constraints. By supporting a learner's attempts at participation in the Discourse, no matter how tentative, the teacher is empowering the learner to participate. In the multilingual South African terrain, first attempts may more likely be in a learner's main language and as the learner increases his/her participation more use of the formal mathematical register (in home language and/or English) can be introduced. The learner could be described as a language or Discourse apprentice, participating more and more in the required Discourse over time. Lave and Wenger (ibid) also point out the importance of "access to the learning potential of a given setting" (p. 43) which can also be seen as related to a learner's command of the required Discourse, in that the required Discourse becomes a gatekeeper for learners' full participation. By increasing the participation of all learners in the required Discourse, revoicing is viewed as an enabler to equalise the access of learners to mathematical knowledge.

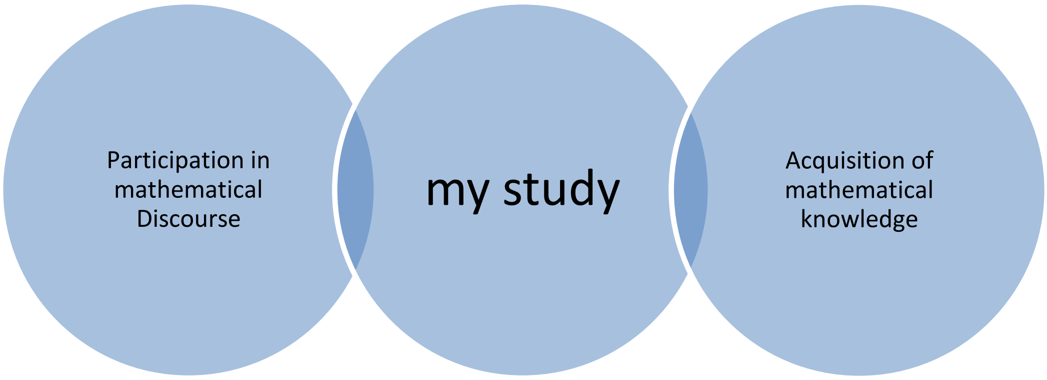
According to Lampert & Cobb (2003), mathematical communication has to be taught but it also has to be used to develop mathematical thinking amongst learners. They have summarised this idea into the phrase "communicating to learn and learning to communicate" (p.238). They suggest that this exemplifies the tension between the acquisition and the participation metaphors for learning which was first identified by Sfard (1998). At one end of the spectrum lies the view that learning is the acquiring of a product, mathematical knowledge, and at the opposite end of the same spectrum is the view that learning is a "process of coming to participate in established mathematical practices" (Lampert & Cobb, ibid, p.237).

It is suggested by the latter authors that if learning can be seen as *"increasingly competent participation in mathematical practices that have been developed over a period of centuries and that constitute students' intellectual inheritance"* (ibid),

then "learning to communicate" cannot be separated from "communicating to develop mathematical understandings" (p.238). These two features complement each other and both lie somewhere within the spectrum of the tension mentioned above.

As mentioned in the first chapter, my interest is in the different types of revoicing strategies used in mathematics classrooms today which have the potential to either support or constrain the appropriation of the required mathematical Discourse. In this view, appropriation of mathematical Discourse has the potential to lead to the acquisition of mathematical knowledge and therefore situates my study at an interim position along the acquisition/participation spectrum as represented in the diagram below.

The acquisition/participation spectrum




It is therefore within this realm of the learner as an apprentice in the mathematics classroom that the potential to participate in mathematical Discourse can be observed and analysed. The realisation of this potential depends on the teacher's ability and willingness to encourage and support this type of Discourse appropriation.

I now go on to detail findings in the mathematics education literature that link to the notion of mathematical learning as Discourse appropriation. I include studies that have focused on the types of strategies used by teachers to encourage such Discourse appropriation.

**MATHEMATICAL LEARNING AS DISCOURSE APPROPRIATION**

Forman (1996), cited in Lampert & Cobb (2003), views mathematical learning as "an apprenticeship into the Discourse and reasoning practices of mathematically literate adults" (p.239). To elaborate on the notion of Discourse, Moschkovich (1999) draws on Gee's (1996) broad definition of Discourse. Gee (ibid), as already mentioned, describes Discourse as "ways of being in the world, words, acts, values, beliefs, attitudes, social identities, gestures, glances, body positions, clothes etc......" (p.127). In order to be part of a community, one has to participate in the Discourse. His famous example of belonging to a biker gang which involves speaking, behaving and wearing similar clothes enables us to understand this broad idea of Discourse. A South African parallel is the way in which political activists in the 1980's could often spot a security policeman by his shoes or his moustache, before he had even opened his mouth.

The mathematical Discourse practices promoted in the NCTM standards (1989) and the Assessment Standards of the NCS (2008) include explaining, generalizing, abstracting, justifying and conjecturing. In the classroom, learners are expected to behave in acceptable ways as they participate in mathematical Discourse.

This idea resonates with Yackel & Cobb's (1996) notion of social and sociomathematical norms which learners learn while participating in mathematics lessons. Lampert and Cobb (2003) suggest that "talking about talking about mathematics" (p.239) is very important. Learners don't automatically know what it means to "give a mathematical explanation" (ibid) and can be supported in learning this "sociomathematical norm" (Yackel & Cobb, ibid).

An example of a sociomathematical norm might be found in Lampert and Cobb's (2003) idea of "mathematical politeness". They talk about the importance of learning how to disagree "in ways that are mathematically productive and socially acceptable" (p.239). It's not enough to merely say things in the classroom. They need to be said in the correct manner. A learner is expected to "build on" or even "reject" (ibid) statements made by their peers but it must be done politely in order to be productive and constructive and to avoid hurting feelings.

Learners who have already participated in these practices at home, perhaps around a kitchen or dinner table, are more likely to find polite Discourse easy to engage in. O'Connor (1998) suggests that "arguments or the provision of justification to parents and siblings" may be precursors to "mathematical arguing, making claims, providing justifications or co-constructing of definitions" (p.27) which are more abstract forms of classroom Discourse. E.g. If a parent accepts the child's justification (for coming home late) as valid, s/he might be encouraged to expect similar validation in the classroom and risk a justification in a group or class discussion. As an example a child might justify why they came home late by arguing that it started to rain and s/he didn't want to spoil her/his schoolbooks so s/he waited for the rain to subside. This type of thinking can be harnessed in a classroom to justify choices during problem solving activities.

However, the child whose parent scolds her/him for being late no matter what justifications are given, will likely not want to participate in this kind of activity at school, fearing being shut down in some form or other. This relates to Bernstein's (1996) idea of social distance between home and school and how cultural practices in the home can prepare or delay a learner's access to full participation in the school environment.

Besides ways of talking it is necessary for learners to participate in using the "maths register" Halliday (1978). Words like hypotenuse, pi, arc, rational, function, inverse .... all have a particular meaning in mathematics and sometimes a different meaning in everyday language. Using the correct register at the correct time shows how the maths register is part of Discourse. Even different aspects of mathematics have their own registers, all of which are encompassed by Discourse, such as Euclidean and non Euclidean geometry (Rittenhouse, 1998).

## The Teacher's role

O'Connor (1998) asks the question, "How might discourse activities in classrooms, orchestrated by teachers and other experts, provide for the socialization and enculturation of the student, leading to the development of the self as mathematically capable?" (p.19). This question points to the important role of the teacher in fostering this process of enculturation and development of the learner. In this study the focus is on the nature and extent of the feedback provided by the two teachers.

## Borrowing musical concepts

The term, orchestration is borrowed from the discipline of music and is extremely apt in this work. Northrop Frye in his work, The Educated Imagination, describes mathematics as "one of the languages of the imagination, along with literature and music"(p.2).

The use of musical terms originates in the NCTM Standard number 2 which is as follows:

The teacher of mathematics should orchestrate discourse by-

- Posing questions and tasks that elicit, engage , and challenge each student's thinking
- Listening carefully to students' ideas
- Asking students to clarify and justify their ideas orally and in writing
- Deciding what to pursue in depth from among the ideas that students bring up during a discussion
- Deciding when and how to attach mathematical notation and language to students' ideas
- Deciding when to provide information, when to clarify an issue, when to model, when to lead, and when to let a student struggle with a difficulty
- Monitoring students' participation in discussions and deciding when and how to encourage each student to participate (p. 35).

Another musical concept, polyphony, describes music which has several different musical lines being played simultaneously to create sounds which are sometimes harmonious and other times conflictual, depending on the context and the purpose for creating the music. Orchestration is the bringing together of various musical lines which are played by different instruments (voices) which combine to form a coherent whole. Gustav Mahler (1860 - 1991), one of the greatest orchestrators was able to bring the different voices together without the one drowning out the other. In using these terms to describe what can happen in the mathematics classroom, one can see the teacher as the orchestrator and the learners' statements as the voices which produce the polyphony. Sometimes the learners' ideas are in conflict and at other times they will be in harmony with each other and with the discipline of mathematics.

A wide range of teaching strategies have been explored in response to the NCTM (1989) publication of standards. These range from radical constructivist notions of getting the learners to figure it all out themselves (Fosnot, 1996), to others including Staples (2007) and Brodie (2008, 2010) who suggest ways of giving feedback during whole class discussions which enhance the learning experience. Some researchers such as Stein et.al., (2000) have focused on the nature and level of the mathematical tasks that are given to students while others, (Moschkovich, 1999), have focused on the language practices used in classrooms

Moschkovich (1999) who stated that the NCTM (1989) standards still don't provide sufficient guidance as to how to orchestrate the polyphony of voices in the classroom, spells out some teacher practices needed to support a focus on mathematical discussions.

- engage students in arguments for or against a statement (move beyond "agree" or "disagree") .
- encourage student conjectures and explanations
- model desired participation and talk; support these when displayed by students
- encourage student –to-student talk
- ask students to paraphrase each other's statements

**Changing Patterns of Communication**

Sinclair & Coulthard (1975) and Mehan (1979) identified the Initiate, Respond, Evaluate/Feedback (IRE/F) pattern of communication between teacher and learners as one of the practices that has stuck firmly in the pedagogical toolkit of teachers. Several researchers, among them Stein, Grover & Henningsen, (1996, 2000), Davis (1997), Moschkovich (1999), Forman & Ansell (2001), Brodie (2007, 2008, 2010), have looked for alternatives to this pattern, such as orchestration of mathematical Discourse using revoicing. The reason for this search for an alternative interaction pattern, is the ease with which the IRE/F pattern can slide into what Bauersfeld (1980) identified as a "funnelling" pattern. Funnelling is a questioning style used by teachers whose main focus is getting to the correct answer. A teacher might start out asking a challenging question but when her/his learners can't give the answer, s/he asks more questions which get easier and easier to answer until learners are answering questions way below their level of competence. On the other hand, Brodie (2008, 2010) suggests that fostering alternatives to the IRE/F pattern is no easy task and that we still need to explore aspects of the IRE/F pattern. The difference between the IRE and the IRE/F pattern are significant for my study. The IRE format ends with the teacher evaluating the response of the student and then initiating another question. The IRE/F format has more potential for discussion and learner participation in that the teacher is giving feedback which can potentially broaden into an orchestrated discussion but can also narrow the participation of a learner. Brodie (2010) cites improvements to the feedback (F) part of the IRE/F as a step forward. She further suggests that the benefits are dependent on the ways in which teachers use this pattern, rather than in the pattern itself. Revoicing fits into this category of feedback as the teacher is mostly doing the revoicing her/himself, or asking other learners to revoice something which has already been said. Cobb, Yackel, and Wood (1992) give support to this idea of feedback when they suggest that it is the teacher's role "to facilitate mathematical discussions between students while at the same time acting as a participant who can legitimize certain aspects of their mathematical activity and sanction others" (p.102). Over time, students themselves can begin to realise that they have the power to decide on the correctness of a mathematical assertion.

Chazan & Ball (1999), who responded to what they describe as "reform exhortations not to tell" (p.2), presented ideas as to what a teacher in a reform classroom can do. An example given is to remind students of the conclusions they had reached during discussions the previous day. This view has been affirmed by Lobato et al., (2005) who also argue for a more assertive teacher role.

According to Lampert & Cobb (2003), the teacher's role is to mediate the apprenticeship role of the learners, giving support to their increasing participation in mathematical Discourse as they move from informal to more formal mathematical understandings.

These ideas link well to the role of the teacher as an orchestrator.

In line with this thinking, O' Connor (1998) says, "It is sometimes necessary to develop a working definition of some phenomenon or process, a definition that will change as understanding increases" (p.43). The restating, by the teacher, of a student's informal definition in a more formal mathematical way is a key practice in increasing learner participation. This process of restating has come to be called revoicing and it is the Discourses relating to different kinds of revoicing practices that are the central focus in my study. I now go on to discuss revoicing in detail.

**What is revoicing ?**

The practice of revoicing was mentioned in chapter 1 as being introduced into mathematics research Discourse by O'Connor & Michaels (1993, 1996). Their ideas were based on the work by Goffman (1981) on participant frameworks. Enyedy et al., (2008) remind us that there are historical antecedents to the notion of revoicing which can be traced back to Vygotsky's (1978) idea of the "appropriation of other's voices", Bakhtin's (1981) reference to polyphony as well as Goffman's (1981) notion of reported speech – uttering and re-uttering.

O'Connor & Michaels (1996) distinguished between repeating and rephrasing as two main types of revoicing. In particular they proposed the use of revoicing as a way of developing mathematical argumentation by positioning learners in relation to each other as well as in relation to the field of mathematics. When a learner makes a propositional statement, a teacher may revoice the statement in two main ways. Firstly she may revoice the statement by repeating it to the class giving ownership to the learner for that statement. She may also ask another student to revoice the statement. Secondly, she may choose, or ask another student, to revoice the statement in a more mathematical way but still giving ownership to the original learner. When a second learner takes part in the discussion, the teacher may then revoice the second learner's statement in relation to the first learner's statement. In this way the teacher is helping learners to make their views explicit and to participate in argumentation and debate, whilst communicating what a "more mathematical" statement looks like.

Since the introduction of revoicing to mathematics research in the early 1990's there has been a flurry of literature which attempts to unpack the concept. Key contributors are Forman and Ansell (2002) who elaborated revoicing in the following way:

> One primary means for orchestrating discussions in classrooms is through revoicing (Forman et al., 1998; O'Connor & Michaels 1993, 1996). Revoicing involves repeating, rephrasing, summarizing, elaborating, or translating someone else's speech. In its most straightforward form (repetition), revoicing provides an additional opportunity for an utterance to be heard, thereby allowing more time for listeners to reflect on the utterance. In its more elaborate forms (rephrasing, summarizing, elaborating, and translating), it allows the listener to reframe the speaker's utterance in a way that can be evaluated by the original speaker as well as by other listeners. In this way, listeners can try to clarify a speaker's utterance by articulating presupposed information, by substituting technical vocabulary for less precise linguistic items, or by further explicating the speaker's intentions. Also, through revoicing, a second speaker can provide needed empirical or logical support for the first speaker's argumentative claim. Finally, revoicing is a means of aligning proponents of an argumentative position. (p. 258).

The idea of aligning proponents of an argumentative position supports O'Connor & Michael's (1996) notion of revoicing to position learners in relation to each other or to the discipline of mathematics. The teacher's orchestrator type role here is to scaffold a mathematical debate helping students to see what the arguments are and who in the class holds similar or antagonistic positions.

Forman & Ansell (2002) suggest that teachers who use revoicing to orchestrate discussions successfully tend to give feedback in the following ways: (my own comments in italics explain the purpose of the particular revoicing statement or question)

- So, you are saying that...... (*this is confirming with the learner that she has heard correctly but also gives the class a chance to hear the idea again)*
- What can the rest of you add to Phumzile's idea? *(asking the class to engage with the idea requires them to think about it)*
- What can you say about....... *(starting where the learners are)*
- Can anyone explain to us in your own words what Denzil has just said ? (*inviting another learner to rephrase Denzil's idea which keeps it in the public domain and lets the teacher know if the other learner has understood the idea)*
- Please can you say that in another way? *(inviting learners to rephrase the idea)*

All these questions above are open ended, encouraging students to think further and giving ownership to the students for their ideas. When one learner makes a statement, the teacher encourages other learners to interact with the idea, add to it, restate it, challenge it etc... By revoicing in this way, the idea remains in the public realm for longer and provides learners with the time to engage and think about the ideas. This is real orchestration of ideas which leads to access to conceptual understanding and more abstract mathematical thinking and in the words of Lave & Wenger (1991) "access to the learning potential of a situation" (p.42).

Lampert & Cobb (2003) suggest that revoicing is important in moving the pedagogical agenda forward (O'Connor & Michaels 1993, 1996), when teachers "reformulate a student's contribution verbally or in writing" (p.245). In chapter 4, I note how Bongani, unlike Refiloe, had difficulty moving the pedagogical agenda forward.

Brodie (2008, 2010) explains that she prefers to use the term "maintain" as she is not seeing revoicing as positioning (O'Connor & Michaels 1993, 1996) of learners, but merely as a way to keep the ideas in the public realm. As Brodie (2008, 2010) sees "maintain" as the only revoicing feedback move, I have chosen to distinguish between revoicing and non-revoicing feedback moves in my model. I refer to Brodie's (ibid) categories of elicit, press, confirm and insert as non-revoicing moves.

My own idea of revoicing, as a feedback practice, is broader than that of Brodie (2008, 2010), in that I see it as doing more than keeping the idea on the table. My view has its root more in the elaboration of Forman and Ansell (2002) in that I distinguish between types of revoicing such as repetition and rephrasing and then operationalise these two types of revoicing. I view the category "maintain" as only one of the ways that revoicing can be used, and this reflects my concern with revoicing strategies, even when they are used in ways that may lower the level of the task, work with alternative goals or fail to move the pedagogic agenda forward. Amongst other uses, it is a practice which affirms learners and can provide learners with access to mathematical language and thinking. In my empirical data, I also saw limitations in the way that revoicing was practiced – these limitations are dealt with in chapter 4.

In the following sections, I consider international literature which suggests a range of ways in which revoicing can occur in classrooms, and use this to develop my own set of indicators of "repeating" and "rephrasing" based on this evidence.

**From informal to formal mathematical language**

In this section I deal with the role of revoicing in helping learners' communication to move from informal to formal language. This was written about by Pimm (1991) and taken up by Setati and Adler (2001) in relation to the South African multilingual context. Setati suggests that the reasons that many schools choose English as the LoLT, as mentioned earlier, are political and complex. It is therefore perhaps preferable in the short term to rethink the way we use language rather than force children to learn in their home language. She suggests the use of strategies such as providing a task in English as well as in a learner's home language. Another strategy is to encourage learners to use home language during groupwork and then to report back to the class or the teacher, in English. The reasons for success or lack of success in learning in the classroom are complex and cannot be attributed solely to language. Even schools which use home language as the LoLT have teachers who struggle to give coherent lessons (Venkat & Naidoo, forthcoming). A teacher's attitudes, beliefs and her/his own level of conceptual understanding of mathematics will impact on her/his teaching methodology and hence on the learners' development and understanding of mathematics.

An important aspect of communication is the language used for learning and teaching. This is a contested arena within the South African research community with Alexander (1999) putting forward a case for studying in one's home language and others such as Howie (2002) saying that learners need to learn more English in order to succeed in mathematics. The current thinking in the SA government as it appears in the Curriculum And Policy Statement (CAPS) document (2011), aligns more with Howie's (2002) position in that English is being introduced as a First Additional Language (FAL) in 2012 from grade 1. I mention the CAPS document as it indicates an increasing trend away from multilingualism in schools. As mentioned in chapter 1, parents and teachers also have strong views on this subject, mostly arguing in favour of more English sooner and English as the language of instruction (Setati, 2005). Both teachers in my sample indicated that they share this view.

Gee's (1996) theory of cultural models is useful in helping us to understand the choices made by groups within a society. He says, "Cultural models are a type of theory, often tacit, involving beliefs about the distribution of "goods" – prestige, power, desirability, centrality – in society..............the assumptions they embody about the distribution of social goods appear to us natural, obvious, inevitable, even appropriate" (p.79). Setati (2005) draws on Gee's theory to explain how black parents in South Africa feel it necessary for their children to learn in English in order to have access to the good things in life. The impact of this decision, she says, is that learners' epistemological access to mathematics is sacrificed. These cultural models determine the Discourses we use and so influence the Discourses used in the classroom. If a teacher believes that multilingualism can enrich the learners understanding, it will be encouraged and will effect the way in which learners and teacher interact.

I have chosen in this study, for pragmatic reasons, not to challenge the cultural model which calls for English as the LoLT but to look, in the meantime, for ways to support learners who find themselves in this challenging situation. Revoicing, drawing particularly on a learner's main language as a resource, is one of the ways to enact support for all learners but particularly for those who are learners of English. In order to do this I draw on Setati and Adler's (2001) model (fig 2) of "Informal spoken language to formal written language" (p.249) which in turn is based on David Pimm's (1991) model seen below.

Pimm (ibid) wrote, "One difficulty facing all teachers is how to encourage movement in their pupils from the predominantly informal spoken language with which they are all pretty fluent (Brown, 1982), to the formal written language that is frequently perceived to be the hallmark of mathematical activity" (p.21). He suggested two ways to achieve this movement. One way is to write the informal ideas and try and move towards more formal written work as in *fig 1 below,* the route with the dashes.

Another way is to "work on the formality and self-sufficiency of the spoken language prior to its being written down" (p.21) as in the route with the dots.

Pimm's model

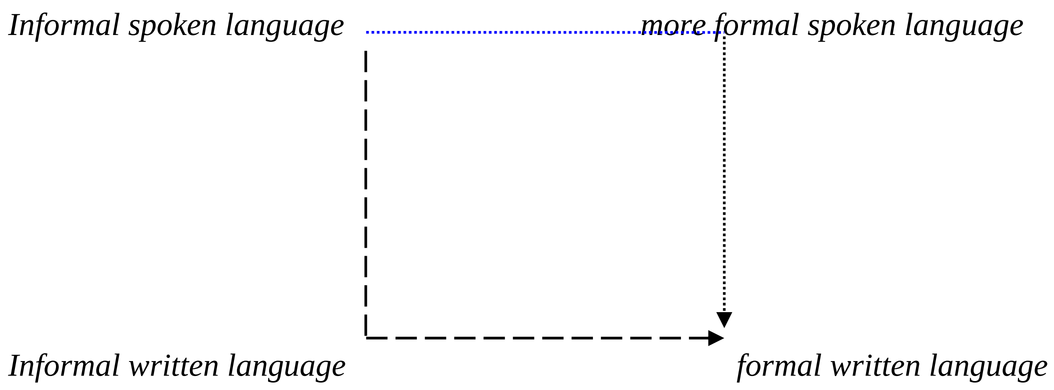



*Fig 1*

Although I include written conceptions of what students say as a form of revoicing, my study is concerned more with Pimm's (1991) second route, which follows the spoken route from informal  to more formal communication. This concern is based on evidence (Taylor & Vinjevold, 1999) of a predominance of oral work being done in South African classrooms in relation to the paucity of written work. The notion of moving from the informal to the formal has broader ramifications in a multilingual classroom in that learners may begin their informal utterances in their home language and take several routes towards the formal mathematical discourse in English (Adler & Setati, 2001). These authors have extended Pimm's (1991) model to show these various possible routes a learner can take in order to progress within the discipline. Their model shown below takes into account the complex multilingual environment in South African classrooms.

Setati & Adler's model

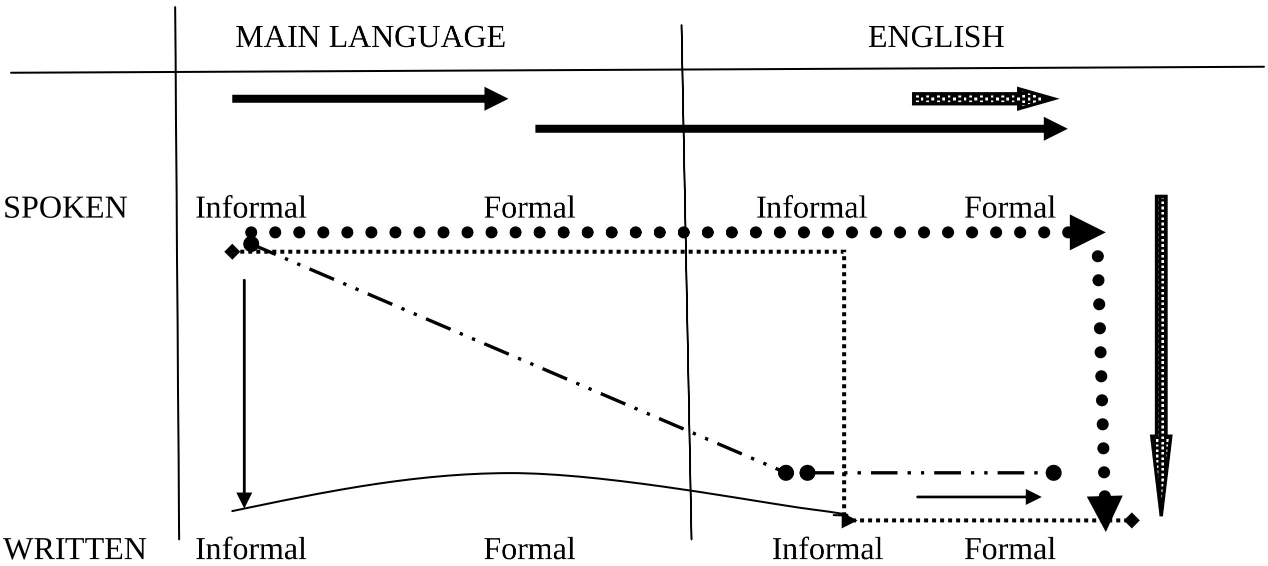
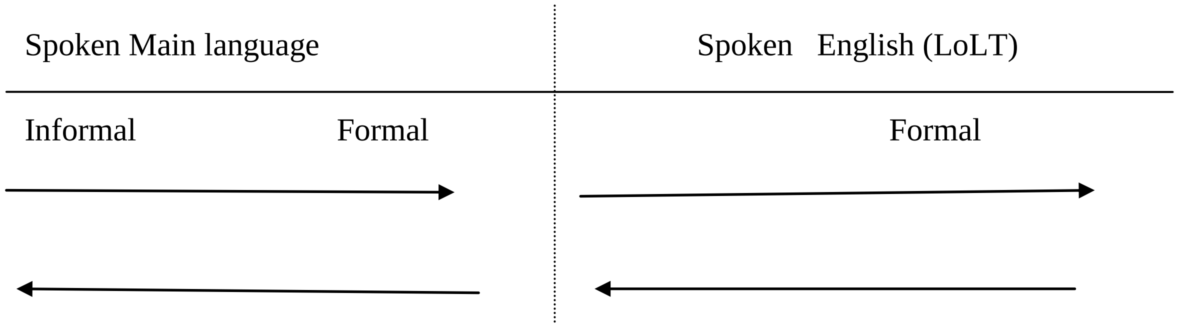


*Fig.2*

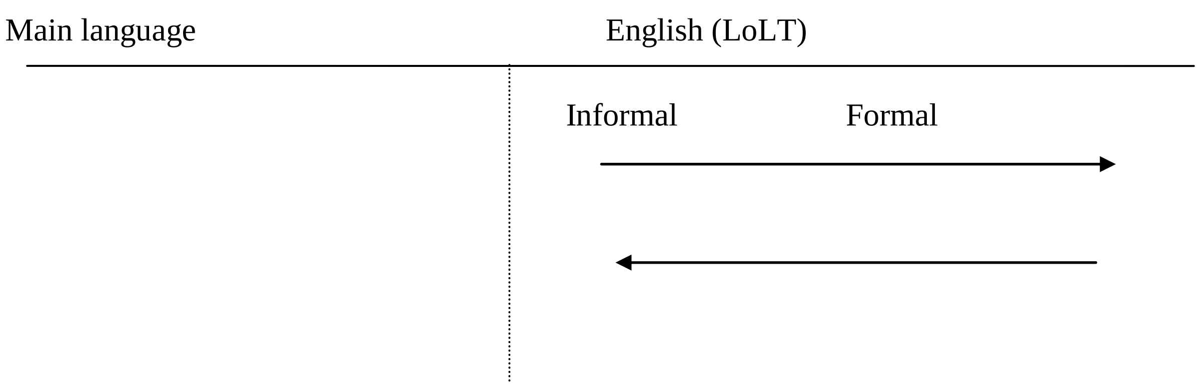
As mentioned earlier, I focus particularly on spoken communication rather than written given evidence of extensive emphasis on oral communication in SA classrooms. According to international literature (Kaiser & Huntley, 1999) it is known that teachers often begin their lessons with the introduction of “formal and complex subject matter” (p.81). Taking this into account I have therefore produced a model with three options (fig 3) which includes a reflection of the original model as it is feasible that a teacher may voice a formal concept and then use revoicing to ensure that the learners understand the concept.

<u>Three options model</u>

OPTION 1:




OPTION 2:



OPTION 3:

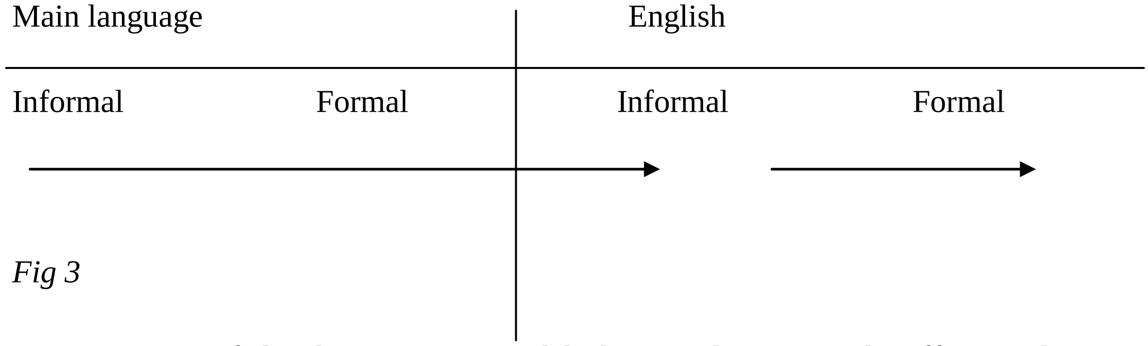



*Fig 3*

In OPTION 1 of the three options model above, a learner might offer an idea in a very informal way in her/his main language (top left of the model). The teacher might then ask another learner to say the same thing in another way. The second learner revoices the idea as is or more formally in home language. The teacher might then revoice the utterance in formal English.

The arrows pointing in the other direction suggest that the teacher might express a formal mathematical idea and then revoice it herself or ask learners to revoice in less formal ways and/or in their main language to check for understanding.

OPTION 2 shows that this process is only happening in English, the medium of instruction being promoted in the two schools in this study.

OPTION 3 suggests moving from a statement in the learners' informal main language to informal English and from there to formal English.

Although the models suggest linear movement, it is also possible that teachers and learners move back a forth between the various options. Talking in back and forth directions may prove to be an equally powerful way to explore and develop understanding and the ability to communicate that understanding. I am therefore analysing revoicing using OPTION 2 as both the teachers in my study chose to teach in English and did not encourage any use of home languages.

As the majority of classrooms in South Africa are multilingual, the work of Moschkovich (1996, 1999, 2002, 2007), Enyedy et al., (2008), Setati (1998, 2005) and Adler (1998, 2001) are of particular interest. They have all looked at language practices in multilingual classrooms, either looking at revoicing in particular or indirectly. Although most research has been done in classrooms where teachers speak the same language as learners, multilingual practices are also possible in classrooms where the teacher doesn't speak the language(s) of the learners as learners can be encouraged to revoice each other.

**Home language, a resource, not a hindrance.**

Moschkovich (1999) asserts that we should see a learner's main language as a resource which can be used in the classroom to communicate mathematical ideas. Rather than "diminishing" the level of Discourse, she asserts that by bringing English as a Second Language (ESL) learners into the conversation, one is exposed to alternate ways of looking at the subject leading to an enriched tapestry of ideas. My study explores teaching practices which aim to orchestrate the polyphony of voices in the two classrooms in my sample and identifies examples of the different voices which make up the polyphony. Moschkovich (1999) suggests that revoicing is one of the practices, in contrast to what she calls, the standard (IRE) pattern, that can be used to achieve this. She suggests two ways in which revoicing can support mathematical talk by students.

- accept the student's response, use it to make an inference and allow the student to determine it's correctness.
- reformulate a student's utterance in a more formalised mathematical way. In her example, Julian uses the term "paralella" which the teacher reformulates as "sides". Later, Julian appropriates the word "sides" to explain his thoughts to a peer.

Moschkovich (1999) is promoting the idea that "various ways of talking can contribute in their own way to the mathematical discussion and bring resources to the conversation". She continues... "to diversify our view of the different ways that students talk about the mathematical objects and situations, to uncover the mathematical aspects of what students are saying and to be able to hear better the variety of ways in which students can communicate mathematically" (p.17). This quote shows how she sees the participation of ESL learners in the classroom, as adding a richness to the conversation, rather than detracting from it.

Moschkovich (2002) adds that in learning to communicate mathematically, learners are also participating in Discourse practices which involve reasoning, making and connecting claims to representations, being explicit about assumptions, thinking creatively and making predictions. We can see that her view of what counts as competence goes much further than finding the right word in the right language. She has shifted the focus from learning words to learning mathematics by using whatever discursive resources one has, all languages, gestures, the situation and the informal everyday register.

This explicit style of teaching, called "genre instruction" by Lampert & Cobb (2003), they suggest, has the potential to "afford students from a wide range of cultural and economic backgrounds access to mathematical communication" (p.243). In doing this, the teacher needs to be accepting of learners' informal utterances while at the same time making learners aware of the more precise mathematical ways of talking. Lampert (1990) shows how she explicitly discussed the mathematical importance of conditions, assumptions and interpretations in helping grade 5 learners to revise their definitions.

**Constraints on communication in the mathematics classroom**

Revoicing has been given an important place in the literature as a reform practice which develops understanding. E.g O'Connor & Michaels (1996) as well as Enyedy et al., (2008) focused on an advanced form of revoicing which fosters debate amongst the students in a particular classroom. Enyedy et al., (ibid) suggest that teachers' beliefs about teaching as well as the richness and extent of their 'pedagogical toolkit' (p.157) determine whether they use revoicing to foster debate or in less advanced forms such as repetition and rephrasing.

However, the literature also suggests that revoicing is not yet widely used and that various other interaction patterns used by teachers during whole class discussions are more prevalent and may even be detrimental to learning. An example of this is the interaction pattern, mentioned earlier, known as "funnelling" (Bauersfeld, 1980; Stein et.al., 2000; Brodie, 2007)

It is my view that revoicing will not automatically establish the preferred type of Discourse in the classroom. It still requires a certain level of sophistication by the teacher to use the practice productively. To back up this view, Setati (1998) has shown how some teachers use chanting and chorusing to try and cement ideas in learners' minds. This type of revoicing, with the learner repeating what the teacher says, would be regarded as an instance of teaching at a very low cognitive level as there is no attempt to develop any form of understanding.

This idea adds to Setati's (2005) finding that English was used for procedural discourse such home language was used for increased understanding. This finding suggests that teachers who only use English in the classroom may be locking themselves into the teaching of procedures and denying their learners the benefit of conceptual understanding of the mathematics.

Given the mixed responses by parents and teachers regarding multilingualism (Setati, 2005, 2008), it is common to find classrooms which are completely multilingual, yet only English is being used by the teacher and the learners. In exploring schools for my research I came across signs on the walls at more than one school reminding learners that only English may be spoken at school. This contradicts most research about multilingualism and could also have damaging psychological effects on learners who are being “told” that their home language has no place in the world of education and therefore in the broader society.

I will therefore be looking at the various types and purposes of revoicing practices which are being used in the “English only” yet multilingual linguistic environment. My aim is to investigate the ways in which the two teachers orchestrate discussion in their classrooms using a range of both revoicing and non-revoicing practices. I have drawn from the literature, namely from Brodie’s (2008, 2010) categories of feedback which can be classified into non-revoicing (elicit, press, confirm, insert) and revoicing (maintain) categories, as well as O’Connor & Michael’s (1996) and Forman & Ansell’s (2002) broad categories of repeating and rephrasing. A summary is given in the table below.

Non-revoicing and revoicing feedback

| **TEACHER FEEDBACK** | | |
|---|---|---|
| | **Non revoicing** | **Revoicing** |
| Brodie’s categories | Elicit | Maintain |
| | Press | |
| | Confirm | |
| | insert | |
| O’Connor & Michael’s categories | | repeating<br>rephrasing |

*Fig 4*

Forman & Ansell (2002) agree with Moschkovich (1999) that orchestrating classroom Discourse is an alternative to the IRE/F and that revoicing is a “distinctive feature of this alternative model of classroom discourse” (p.119). Having begun my study with this notion of a teacher’s use of revoicing, but seeing more limited evidence promoting an alternative model of classroom Discourse in my data, I moved to taking a more pragmatic view as suggested by Brodie (2010), that revoicing can be used as a possible way of improving teacher feedback within the IRE/F model. My understanding of revoicing has been further deepened by the examination of my empirical data which created a need for more detailed revoicing categories. I have therefore taken the overarching categories of repeating and rephrasing and created a subset of categories as seen below, which better fit my empirical data.

Subcategories of repeating and rephrasing.

| O'Connor & Michael's categories | **Repeating** | **Rephrasing** |
|---|---|---|
| My own extra categories | Affirm | Into English |
| | Access | Into Mathematical language |
| | written | Deconstruction |
| | | funnelling |

*Fig 5*

Together these subcategories will allow for detailed data analysis and representation. This full model and its constituent categories is presented in the section which follows as the analytical framework for the study.

**MY ANALYTIC FRAMEWORK/CODING MODEL**

My coding model falls within the broad structure known as IRE/F format (Mehan, 1979). This format begins with the teacher initiating by asking a question or making a suggestion, followed by some form of response by a learner. After this, the teacher will either evaluate the learner's response or will provide some form of feedback.

In the diagram below I show where revoicing can be located with respect to the various teaching moves (Brodie, 2008) teachers make during a whole class discussion. The purpose of these moves is to support learners' attempts at mathematical sense making. For the teacher to revoice, s/he needs to listen to what students are saying and either repeat it or reformulate the learner's informal statement in a more formal mathematical way. Brodie's (ibid) conception of revoicing which she calls "maintain" is that it is less challenging for the teacher or learner. This idea links to Forman & Ansell's (2002) assertion that rephrasing is a more advanced form of revoicing than repetition. Given the difficulties in changing from traditional style teaching to reform teaching, this follow up move of revoicing may have the potential to help teachers in South Africa affect this change without needing to abandon the IRE/F format (Brodie, 2004; Mehan, 1979). As explained earlier, Forman & Ansell (ibid) refer to revoicing as repeating, rephrasing, elaborating, summarising and translating. I have included both Brodie and Forman's conceptions of teacher moves in the diagram below, *fig* 6 in order to show where my coding model originates.

Wholeclass discussion within IRE/F

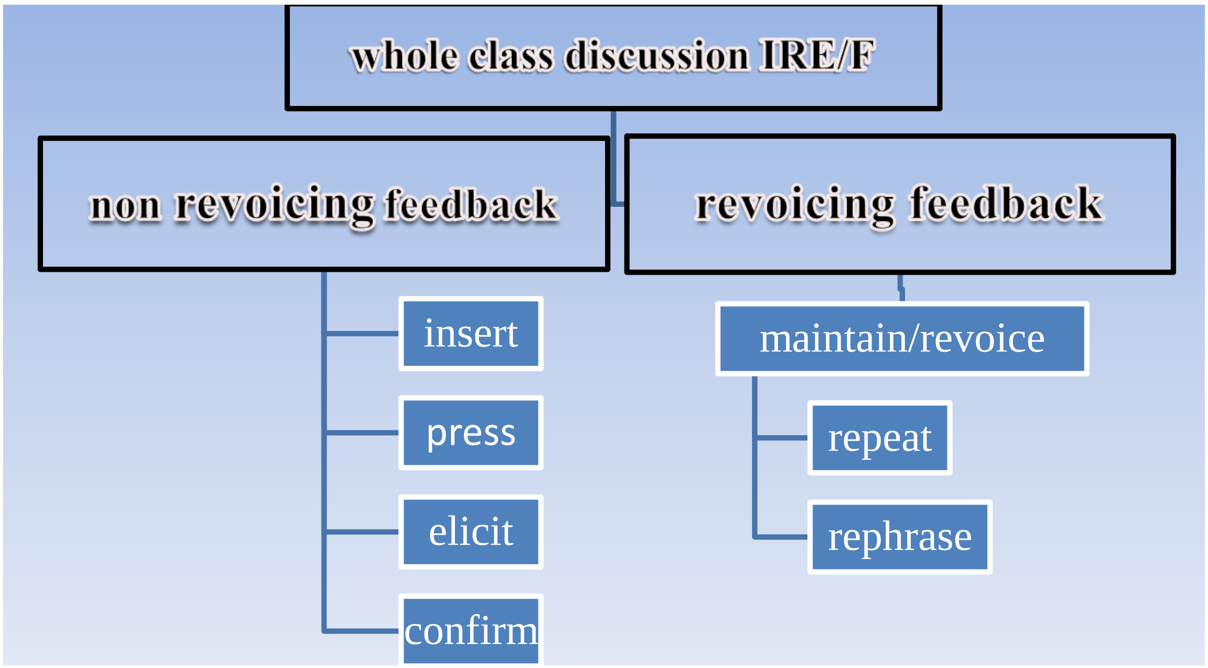



*Fig 6*

In *fig 6*, the IRE/F format is taken from Mehan (1979), the categories press, elicit, confirm, insert and maintain are from Brodie (2008, 2010) and the repeat and rephrase categories are from O'Connor & Michaels (1996) and Forman & Ansell (2002). In my own model, I have chosen to use the category revoice, rather than Brodie's (ibid) category of maintain as my conception of revoicing is broader and closer to that of Forman & Ansell (ibid). However, I have also not used all of Forman & Ansell's categories, summarise, translate and elaborate, as they can either be subsumed under the two main categories of repeating and rephrasing or were not used by the teachers in my sample. E.g. summarising and elaborating can be coded as two different forms of rephrasing and translation was not a feature of either teacher's practices. Overall, I have been guided by my data to finalise a coding model which is representative of what was happening in the two classrooms.

I insert below Brodie's (2008, 2010) explanations of the categories, press, elicit, confirm, insert and maintain

- **Insert** The teacher adds something in response to the learner's contribution. She can elaborate on it, correct it, answer a question, suggest something, make a link etc
- **Elicit** While following up on a contribution, the teacher tries to elicit something new from the learner or other learners. She elicits additional information or a new but

related idea to take the lesson forward. Elicit moves often, but not always narrow the contributions in the same way as funnelling.

- **Press** The teacher pushes or probes the learner for more on her/his idea, to clarify, justify or explain more clearly. The teacher does this by asking the learner to explain more, by asking why the learner thinks s/he is correct, or by asking a specific question that relates to the learner's idea and pushes for something more.
- **Confirm** The teacher confirms that s/he has heard the learner correctly. There should be some evidence that the teacher is not sure what s/he has heard from the learner otherwise it could be press.
- **Maintain** The teacher maintains the contribution in the public realm for further consideration. She can repeat the idea, ask others for comment, or merely indicate that the learner should continue talking.

Although Brodie identifies "maintain" as the only revoicing move out of her five categories of feedback, aspects of her other categories have been incorporated into my own revoicing categories. E.g. Under the heading of insert, Brodie includes elaborating on a learner contribution which can be coded as rephrasing. If the language of the insert was close to the learner contribution, I coded it as rephrasing but if it appeared more as an add-on, I coded it as insert. An example from Refiloe's second lesson in which she was dealing with long division of 724 ÷ 7, is provided to clarify this issue.

| turn | move | Teacher | Learner(s) |
|---|---|---|---|
| 34 | affirm<br>Insert<br>elicit | The quotient.... In long division we came up with our rule. We've got to follow three things. What do we call them? | |
| 35 | | | Division multiplication and subtraction |
| 36 | Affirm<br>insert | And subtraction . We came up with an .... for that. What is that? That should always be on our minds when we talk of long division we've got to remember that. | |
| 37 | | | DMS |
| 38 | Affirm<br>Insert | DMS. So we've got 724 and we've got 7. Where do we start? (*goes through the procedure with learners participating*). | |

| | | | |
|---|---|---|---|
| | Elicit | Answer is 103 rem 3 | |
| 39 | Insert<br><br>Elicit | Normally I would have said to you, you work it out as a decimal but now you've got a remainder and you've got to check this using multiplication so what do you do. (hands go up). What do other ... other people are coming here just to sit. Haibo! W. | |
| 40 | | | We leave it as a remainder |
| 41 | Affirm<br><br>Insert<br><br>Elicit | We leave it as a remainder and then we have to check it using the inverse of division so what do we do? W? | |
| 42 | | | We multiply 7 x 103 then we add 3 |

By looking at the teacher moves in *fig 6* as well as extensive studying of the moves used by the teachers in my sample I have chosen the following categories to analyse their teaching practices. *Fig* 2 shows how the various categories link to each other with the non-revoicing categories on the left as well as the revoicing categories in the rest of the diagram. Maintain is used as the connection between the non-revoicing and the revoicing categories. Under rephrasing, I have included the category "into correct English" in *fig* 5 as that is a move which the literature suggests should be used by teachers (Adler & Setati, 2001) but given the complex nature of language and education, the fact that it virtually did not appear in my sample, is of significance.

How the categories link together

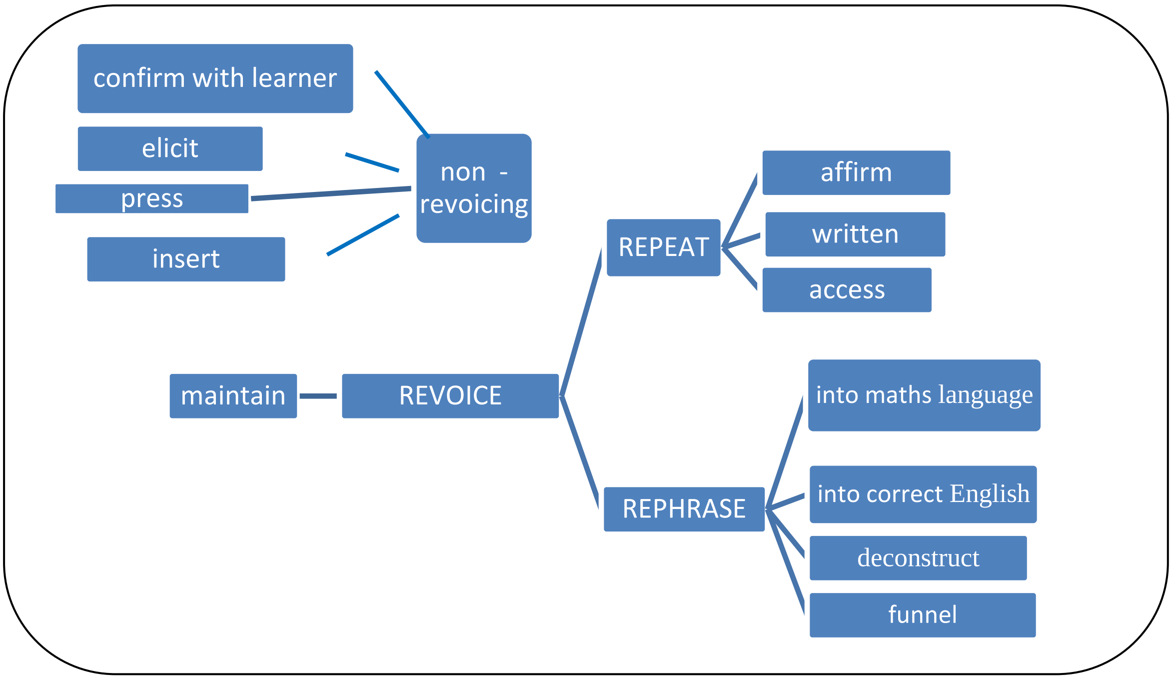



*Fig 7*

Below are explanations of the revoicing categories in *fig* 7 above used in this study, and the sub-descriptions derived from the data for each category

**Repeating**:

- To affirm a learner's answer or statement.

The teacher indicates by repeating the answer or statement that she agrees with the learner.

- To give access to all learners.

The teacher will repeat her own or a learner's question or statement. This is done to give learners a chance to think about the question or statement. This is important, especially for 2$^{nd}$ language learners of English who require extra time to interpret the question correctly.

- Written revoicing.

The teacher decides to write what is being discussed on the board for extra reinforcement or for better understanding of the concepts. This could also be in the form of a diagram.

**Rephrasing**:

- Into mathematical language.

The teacher will reformulate the learner's answer into correct mathematical language. The purpose of this is to model the correct mathematical language which is required at that particular level. This includes vocabulary and the language of justification, conjecturing etc....

- Into correct English.

Often learners don't use the correct English when they answer a question or make a statement. This will be done by the teacher to model the correct language required. This could also involve discussing the meaning of a word.

- Deconstruct.

This practice of deconstructing an idea or concept can indicate a useful way to elaborate without lowering the level of the question. However it can also be used in a way that does lower the level of the question.

The teacher can deconstruct a question in order to support learners who are struggling to understand what is expected of them.

It can also be used after a learner displays that they understand the concept to give access to the rest of the class. The teacher unpacks/deconstructs the procedure verbally or on the board.

- Funnelling (Bauersfeld, 1980) indicates a form of elaboration which lowers the level of the task significantly.

Funnelling occurs when a teacher is focused on getting the right answer from the class and starts to ask questions of an increasingly lower level until learners can give an answer, even though it is oversimplified.

**Categories removed from the original coding model**

The following categories were originally included in the coding model but removed after an initial coding. Below, I summarise the reasons for their exclusion from the model.

**Under the heading of REPEATING**

- To confirm a learner's statement. The teacher checks with the learner whether she has heard correctly by restating what the learner said. This was removed as it was not used by the teachers.
- As a springboard for next question. The teacher repeats the learner's answer or statement and uses it to ask another question which will often involve press – asking the learner to explain or justify their answer. This became the category "elicit".

**Under the heading of REPHRASING**

- To give access to all learners. The teacher will reformulate her own question or statement: Often a teacher can tell that learners don't really understand what they are saying. In this case, they will reformulate the statement or question in another way to give all the learners better access to what they are saying. (This was seldom used by the teachers. In particular, Bongani repeated rather than rephrased questions in order to give what he considered to be access.)
- Written revoicing. Purposive use of the board to help elaborate a learner's idea by writing strategic concepts or words or by drawing a diagram or table etc..... (This was hardly used by the teachers. Again they mostly but not always, used the board to repeat what was being said).

I have already explained my reasons for keeping the seldom used category in my model "rephrasing into English".

**The actual coding instrument for this study**

The categories explained above have been organised into the following coding framework, *fig 8*, for easy analysis.

Coding Framework

| | | | Bongani | | | | Refiloe | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| IRE/F | | | B 1 | B 2 | B 3 | total | R 1 | R 2 | R 3 | total | total |
| Initiate | | | | | | | | | | | |
| Respond (only learners) | | | | | | | | | | | |
| Evaluate | | | | | | | | | | | |
| Feedback | Total feedback moves | | | | | | | | | | |
| | Press | | | | | | | | | | |
| | Elicit | | | | | | | | | | |
| | Confirm | | | | | | | | | | |
| | Insert | | | | | | | | | | |
| | Subtotal | Non revoicing feedback moves | | | | | | | | | |
| | Maintain<br><br>Revoice | REPEATING | | | | | | | | | |
| | | For access | | | | | | | | | |
| | | To affirm | | | | | | | | | |
| | | Written as is | | | | | | | | | |
| | | REPHRASING | | | | | | | | | |
| | | Into correct English | | | | | | | | | |
| | | Into maths language | | | | | | | | | |
| | | Deconstruction | | | | | | | | | |
| | | Funnelling | | | | | | | | | |
| | subtotal | Revoicing feedback | | | | | | | | | |

| | | moves | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Total turns (includes learner responses) | | | | | | | | | | | |
| Teacher turns | | | | | | | | | | | |
| Total teacher moves | | | | | | | | | | | |

*Fig 8*

B1 indicates the coding for Bongani's lesson 1 and similarly R1 is the coding for Refiloe's first lesson. In this way we can see what kind of feedback the teachers are giving, whether revoicing is used by each teacher and to what extent across each of their respective three lessons. We can also analyse each teacher separately and we can look for similarities and differences. We can also see which teachers use the IRE/F structure more as IRE or more as IRF. Nothing will be recorded against "respond" as it is a learner move and not a teacher move. I have included it in the model for the sake of coherence. In chapter 4 an extra layer will be introduced, showing what % each move occupies of the total teacher moves per lesson.

In this chapter, I have traced the theoretical and analytical underpinnings of my study which combines several key ideas from the literature. Amongst these ideas are participation as learning, the learner as a language or Discourse apprentice in the classroom, changing patterns of communication, orchestration of whole class discussion and the role of revoicing in supporting the learner to participate in all of this. The chapter culminated in the presentation of an analytical coding model taking categories from the literature and adding categories suggested by my data. In chapter 4 my findings will be presented using this coding instrument. It will also be used for analysis of the findings, drawing out aspects which have emerged as being of significance to the practice of revoicing.

# CHAPTER 3: RESEARCH DESIGN

This chapter introduces and explains the research procedures for this study and the justification for my choices. It covers the issues of sampling, data collection, reliability and validity as well as ethics.

## INTRODUCTION

In examining revoicing practices of teachers, I have chosen a qualitative case study approach (Opie, 2004), using non participant observation as the main tool, as well as interviews. I therefore have two sets of data. Although the practice of revoicing is promoted in a small section of the research literature (O'Connor & Michaels (1996), Moschkovich (1999), Enyedy (2008), it is not mentioned in Curriculum 2005 or the NCS (2002) and it is thus, not an everyday concept in the terrain of South African classroom teaching. It is for this reason that I believed I needed to observe whether teachers were using revoicing, and if so, how they were using it, rather than rely on their own perceptions of whether they were using the practices that have been described as falling within revoicing in the literature or not. I felt that questionnaires would not be suitable as teachers might easily misunderstand the idea of revoicing. Interviews were useful to corroborate my initial observations and to provide understanding of the two teachers' rationales for their action and practices. The interview data therefore provided an understanding of why specific practices were selected and used in particular ways, supporting the observations which provided a window into the practices that were being used. In order to provide openings for seeing a range of revoicing practices, I chose to video three lessons of each of the two teachers and to interview the teachers after transcribing their lessons.

Observational research, as described in Opie (2004) is aimed at producing public knowledge. This distinguishes it from everyday observations which are for personal use and therefore puts a responsibility on the researcher to be systematic and to analyse and interpret the data as carefully and as objectively as possible.

Denscombe (2007) outlines two types of observation. The first is called systematic observation which falls under quantitative research and the other is participant observation which is associated with qualitative research. Systematic observation which is based on social psychology is the study of interaction in settings such as school classrooms (Croll, 1986). Although it is usually linked with quantitative research, there are several overlaps with participant observation where the researcher is also a participant in the research setting. Both methods involve fieldwork, direct observation as opposed to what people say in interviews and questionnaires about their own practice. Both methods seek to observe what happens on an everyday basis and therefore the researcher needs to be as unobtrusive as possible, something which is very difficult when you come into a classroom with a camera. Denscombe (ibid) reminds us of the contribution made by social psychology which points out the factors which affect the reliability of observation. Two people can watch the same lesson and yet will observe and record what they see differently. They talk of "selective perception" as well as the "frailties of human memory" (p.208). I have used videos of the lessons of the two teachers to try and counteract these aspects but am still aware that my observations are actually interpretations which are influenced by my own views and past experiences. I have also developed a coding model to assist in making the observations as reliable as possible and open to verification.

My own study is a non participant qualitative case study (Ostrower, 1998). I did not want to influence the way the teachers were teaching in any way. I merely wanted to observe their teaching practices in relation to how they allowed for the opening up of Discourse appropriation by the learners. I am therefore a non-participant observer in the process. The coding model provided openings for me to quantify the categories which were identified and thus pointed towards some of the orientations of systematic observation.

**Choosing the teachers: the "cases"**

I chose two cases to study as I wanted to be able to look at the different ways in which revoicing could be used in the classroom and to look at the possibilities for comparison. This is however, not a comparative study.

I started by watching videos of primary mathematics teaching collected in the broader Wits Maths Connect – Primary (WMC-P) project and visited seven different teachers from grd 3 to 6 in both urban and semi urban environments. I finally settled on two ex model C schools where the teachers I observed appeared to be using aspects of revoicing as part of their way of interacting with their learners. Both were teaching Grade 6 classes. Thus, I chose the two teachers purposively because I wanted to focus specifically on revoicing and needed to find teachers who were using it as a pedagogic strategy in their classrooms.

I first explained to the teachers what I was doing and that my research formed a separate sub-part of the WMC-P project. I asked if I could watch a lesson to see if the lesson matched my research focus and that if I decided to do research in their class, it would be completely anonymous. I would not be talking to the principal or the Gauteng Department of Education (GDE) about their teaching and I would be using pseudonyms in my research. All the teachers were very willing except one who delayed the lesson twice but agreed to it, perhaps because I had been introduced to her by the deputy principal. I further explained that I would need to come back a few times to view their lessons and that I intended to interview the teacher afterwards. I felt it important to explain the whole process to the teacher before they accepted being part of the project. Written information sheets and informed consent forms were also provided for the teachers (see Appendix 1).

The two teachers I finally settled on consented to participating in the research, and were happy if not flattered, that I had chosen them. As I have been the subject of research on two occasions and benefited from the process, I wanted to make this experience beneficial for the teachers as well as myself. The first teacher revealed during the interview that he would welcome comment on his teaching so that he could improve. In response I invited him to a workshop at the university and provided him with reading material which could help him to reflect on his teaching style and possibly set some new practices in motion. The other teacher was more self sufficient in her approach but welcomed readings when they were offered to her.

For ethical reasons I refer to the teachers by their pseudonyms, Bongani and Refiloe. Below, I provide brief biographical backgrounds of both teachers in order to provide some contextual background to their revoicing practices.

Bongani was trained at the University of the North at which he did his Bachelors in Education (BA Ed) and Refiloe was trained at the Soweto College of Education where she did a Senior Primary Diploma. She has since done an Advanced Certificate of Education through UNISA and is currently working on an Honours degree in Inclusive Education at the same university. Bongani had taught in several schools at a primary level whereas Refiloe had taught at both a primary and high school level and more recently, had been teaching the same group of learners since they were in grade 4. This provided her with the benefit of an intimate knowledge of the mathematical trajectory of her learners.

Both the schools are quintile 5 which means that the learners pay school fees even though some come from areas with a lower socioeconomic base than the location of the schools. Bongani had approximately 36 learners in his class whom he described as coming mostly from a low socioeconomic background, none of whom were first language English speakers. Refiloe had a mixture of learners in her class of 28 learners, some of whom were from a relatively higher socioeconomic background and were first language English speakers. Refiloe had bright posters all over her class, equipment and easy access to photocopying. Most of the activities seen in learner workbooks were photocopied and pasted flat into the learners' books. Bongani used the chalkboard for learners to copy down the questions. Bongani's school was clearly less well resourced than Refiloe's school. Bongani moved from class to class teaching grade five and grade six whereas Refiloe had her own classroom and the learners (also grade five and six) came to her for their lessons. This enabled her to create a mathematics friendly environment in her classroom. Overall then, Refiloe was clearly working under more favourable circumstances than Bongani.

## DATA COLLECTION

### Videotaping

During the data collection process I was fortunate enough to have an assistant who did the filming leaving me free to take notes. This enabled me to have an extra pair of eyes as a resource. However, the assistant was unavailable for one of each of the teachers' lessons, which meant that I did the filming myself and took no notes on those two days. In all I visited each teacher three times and felt that I was able to collect sufficient and rich enough data for me to analyse. For each teacher two of the lessons were consecutive and the third lesson was a few days later. This was due to interruptions at both schools resulting in the teachers needing to reschedule. The advantage of videotaping is that as an observer, I was able to concentrate on taking fieldnotes and summarising reflections on the lesson. The video can also be re-analysed for text but also for "making sense of non-verbal activity" (Opie, 2004, p.123) such as gesture and the use of the blackboard. Across all lessons, the focus of the videotape was on the teacher, as my research focus was on the teacher's revoicing practices. I was able to capture learner contributions and responses within this. Another result of focusing on teacher practice and not on a specific topic, is that the teachers were able to continue with their normal programme of lessons during the observation period.

All video tapes were transcribed word for word including learner contributions that could be heard and observations which I had made at the time as to what the teacher might be thinking or trying to do. Examples of lesson transcriptions, one from each teacher are provided as appendix 5 and 6.

### Audiotaping

I used audiotaping of the learners as an extra backup of what was happening in the classroom in case there were problems with the videotapes. I brought in two tape recorders and put them on the desks of two groups. Each day I changed where I put the audiotapes. These have not been fully transcribed as I was able to get the whole lesson from the videotapes. From listening to the audiotapes though, I could hear that learners in Bongani's class were using home language to discuss the questions. Whilst learner interaction is not the focus of this study, this is significant in that learners are discouraged from using home language at both schools. Moschkovich (1999) might say here that the learners used their home languages as a resource within their mathematical learning.

### Interviews

Interviews with the teachers were conducted after I had transcribed their lessons so that I could refer to incidents in the lessons and ask the teachers how they understood what was happening. My intention was to explore how the teachers view their teaching practices, revoicing in particular and to verify my understanding of various incidents. The interviews, which were transcribed verbatim, were not intended to be coded but to provide further insights to my own initial observations. I tried to assure the teachers that I was just interested in their views and that there were no right or wrong answers. I was also careful in the interviews not to put my view of revoicing forward as I did not want to influence the teachers' thinking. I was guided by my questions in the interviews but tried to have an open ended discussion. This semi structured style of interview allowed for discussion of some questions more than others (Opie, 2004; Fraenkel & Wallen, 1990). I was guided by the responses of the teachers as to what needed more discussion and what needed more probing. Bongani was far more open in his interview and seemed to be keen to talk. I needed to keep track of the interview questions during his interview because the questions set off such a rich and varied response. The interview with Refiloe was far more stilted and difficult to keep going. Refiloe said that she was nervous and hoped that she could answer my questions which made it difficult for her to engage with the interview more than was necessary- again a sign of her being far more self contained.

My interview schedule and interviews are attached as appendices 7, 8 and 9.

## RIGOUR – RELIABILITY AND VALIDITY

Breakwell, Hammond and Shaw (1995) raise the importance of "researcher effect" in trying to establish reliability, particularly during unstructured interviews. My interviews were semi structured in that I used a schedule of questions but encouraged the participants to go beyond the questions and raise other issues. As already mentioned above, Bongani digressed extensively and I allowed this as I felt it might bring up issues which I hadn't considered which might be of value to my understanding of his teaching methodology. The other teacher stuck more closely to my questions and resisted my attempts to encourage her to speak more broadly.

Another aspect where I needed to be careful was being clear of my own role as a researcher and not a teacher or colleague in the interview situation. Bongani wanted help and even requested a full critique of his teaching which I only responded to after completing the interview. He was also invited to a session on teaching primary school learners at Wits University which he attended. On the other hand, Refiloe treated the process more formally. She cancelled the first appointment for the interview and when it finally happened she revealed her anxiety about the interview. I tried to set her at ease by laughing together a couple of times but my invitations to talk more broadly were not very successful. After the interview was over I slipped back into teacher /colleague role as I had done with Bongani and offered her two articles to read; one on reform style teaching practices and another on the benefits of bilingualism. I chose these articles, neither of which mentioned revoicing but one giving practical ways to prepare for and conduct whole class discussions and the other talks about the benefits of bilingualism. Without being critical of the teachers, I felt that these articles could be helpful to their thinking about their own methodology. I also believed that I was fulfilling part of my responsibility of making the process both collegial and mutually beneficial.

Researcher effect also manifests itself in the classroom, especially on the first day as learners in Bongani's class were excited and well behaved because they could see that they were going to be filmed. Refiloe commented that she doesn't have discipline problems with her class and that their behaviour on the first day was not significantly different from the rest of the year. Her learners did however show signs of excitement and were very aware of the camera, especially on the first day. This enabled the teachers to carry out their lessons without the usual issues of discipline. I believe therefore that I was seeing the teacher's offering under favourable circumstances. During the following observations, the learners and teachers were more relaxed and this was true at both schools.

In order to increase the credibility (Lincoln & Guba, 1985) of the study, I used the interviews to check my interpretations of what was happening in the lessons. I did this by showing or referring to excerpts from the transcriptions and asking the teachers what they thought was going on. To ensure an accurate portrayal of the teachers' practices, I used transcripts of the lessons which had been filmed as well as my own notes written during the lessons. Together with the interviews, I am therefore confident that I have based my study on credible information.

**Reliability of the coding model**

Given the detail and range of data that is present within video, and in order to focus in on aspects related to the study's focus on revoicing, I developed a detailed coding model, presented in the previous chapter, covering both revoicing and non-revoicing categories. To ensure reliability, this model has strong roots in the literature as well as in the practices which I had observed in these two classrooms. At first I planned to use the revoicing categories from the literature, in particular, Forman & Ansell (2002) and Brodie (2008, 2010). However, as I began to analyse the lessons, I could see that the teacher feedback moves did not fit neatly into other people's categories. The teachers were using revoicing in different ways to what was being suggested in the literature. Consequently I developed my own set of categories and codes and found it difficult at times to decide which utterance fitted into which category. There were also times where it became clear that one utterance could fit into more than one category which helped to deal with ambiguity.

An example of the type of difficulties experienced in deciding how to code is shown below. In some instances, Bongani used revoicing to "affirm" his learners, rather than to confirm that what they were saying was correct whereas Refiloe used revoicing often to confirm that the learner had given the correct answer and then moved onto the next question. An example of an "affirm" utterance drawn from Bongani's teaching is as follows:

| | | | |
|---|---|---|---|
| 131 | Elicit | Tell me how many operations did we use there. To get to the answer, how many? | |
| 132 | | | 4 |
| 133 | | *Ignores this answer*. Yes K. | |
| 134 | | | 2 |
| 135 | affirm /elicit | 2 yes its what and what? | |
| 136 | | | L: subtraction |
| 137 | Affirm | T: yes we've subtracted and | |
| 138 | | | L: divided |
| 139 | Affirm<br><br>Insert | : We have divided<br><br>Remember when I said some word problems will ask for more than 1 operation so we have divided and we have subtracted. All happy | |

I have decided to call this category “affirm” and use “confirm” as in Brodie’s categories to mean that the teacher confirms with the learner that she has heard or understood correctly what the learner was saying.  Bongani also stated in his interview that he was using repetition of what learners had said to help his learners because they were not English speaking. Based on his explanation, I call this “access” in the coding model.  In this sense, Bongani was trying to give his learners access to the English meaning of the question. Access in the broader sense to mathematical understanding or in the language of Lave & Wenger (1991) “access to the learning potential of the situation” was less of a focus in Bongani’s class.

**Limitations**

The limitations of my data collection fall into 2 categories; theoretical and practical generalisability.

**PRACTICAL ISSUES**

Firstly both the teachers had well prepared lessons for the first day. The learners were particularly well behaved as they were not used to being filmed and one could therefore say that these lessons, particularly Bongani’s lessons, were somewhat special, rather than reflective of the everyday lessons in those classrooms. The rest of the lessons were more relaxed and, according to Bongani, were more reflective of what normally happened in the classroom. Refiloe stated that her lessons were similar to what happens on a daily basis.

**THEORETICAL ISSUES**

The limitation of a case study research project is that one cannot generalise from such data (Verma & Mallick, 1999). Given the fact that these two teachers were purposively chosen out of a sample of seven teachers whom I observed, particularly because of how they interacted with their learners, one cannot make any firm claims about other teachers. I was looking for teachers who were already using revoicing practices in their classrooms and am unable to claim that this is a practise in other classrooms. However based on the more limited revoicing based interactions seen in both my initial video observations and in the other classroom observations, it would appear that the revoicing practices reported here are likely to be more extensive than those seen in many other primary mathematics lessons. The limitations therefore are at the level of typicality and generalisability. On the other hand, one gains a rich description of what typically happens in these two classrooms in terms of the nature and range of revoicing practices.

## ETHICS

I explained to the two teachers that I would be using pseudonyms in my study, that they would not be identified and that no information identifying them from my study would go either to their principals or to the Gauteng Department of Education (GDE).

I have followed the guidelines of the university in terms of the ethics requirements so as to ensure no harm comes to any of the participants. All video recordings and audio recordings are being kept safe and private while in use and will be locked away safely according to the guidelines as soon as I finish using them.

The learners and their parents signed letters (appendix 2 and 3), agreeing to participation in the study and one parent even sent me an SMS to apologise that his son had not brought the permission slip to school on time but that he wanted his son to participate in the lessons. I took this as a sign that there was a positive attitude to participation in the study.

However, the principal of the one school indicated that she wanted the school to reap some benefit from my study. She was wary of researchers who take but don't give back to the school. This gave me the idea to give readings to the teachers and to invite one of the teachers to a presentation at Wits University and to maintain contact with the teachers from time to time, encouraging them to join the Association of Maths Educators of South Africa (AMESA) and participate in its activities.

In this chapter I have explained how I identified my sample and how I collected the data which I analyse. I have acknowledged the limitations of this study and dealt with ethical considerations as well as issues of rigour, reliability and validity. In referring to the coding model presented in chapter 2, I explained how I endeavoured to design a reliable and valid coding instrument taking categories from both the literature and the data which represented what was happening in the two classrooms. In doing so, I have explained and justified the categories which are included, as well as the categories which have been excluded from the model. At all times I observed the code of ethics appropriate to this type of study and attempted to make this a rewarding experience for the teachers as well as myself.

# CHAPTER 4: FINDINGS AND ANALYSIS

This chapter begins with an introduction to both Bongani and Refiloe's classrooms and their perceptions of their teaching practice taken from their interviews. This is followed with the raw data in coded form and explanations of the various categories of revoicing and non-revoicing feedback moves. My findings are summarised according to my coding model outlined in chapter 2, in both real terms and as percentages of total teacher moves. I look at the number of teacher moves devoted to *revoicing* as compared to *non-revoicing*. I then delve deeper into which revoicing moves are used the most and which are used the least. I explain this in relation to the literature and expand the chapter into a description and qualitative analysis of each teacher's classroom practices. Although this is not a comparative study, there are times when I found it useful to refer to similarities or differences between the two teachers' teaching environments and practices. I conclude the chapter with some findings about language use and some discussion about the difficulties experienced by the two teachers in using revoicing in the way that is suggested in the literature.

## TEACHER INTERVIEW COMMENTS

### Bongani

As stated already, Bongani and Refiloe both teach at quintile 5 ex model C schools and show strong commitment to helping their learners succeed. There were, however, many differences between the two environments. Bongani did not have his own classroom and moved from class to class for each of his lessons. Unlike Refiloe's classroom which was overflowing with maths posters in bright colours, there was nothing on Bongani's walls to indicate that this was a maths classroom. Bongani's learners were all 2nd language English speakers with an African language as mother tongue. He grew up speaking Tsonga as his mother tongue and is fairly fluent in English although there were times where his own difficulties in the command of English created confusion in the classroom. He stated that he could not use the language of his learners for teaching as they spoke so many different languages. He referred to the issue of teaching in English as a big problem, especially in the rural areas such as Mpumalanga where he had taught before, but also at his current school. In response to a question about his learners' ability to learn in English, he stated, "The fact that it's English and the poor child only interacts with the material in English in class. During break it's something else, at home it's something else .....even here in Gauteng." This aligns with the work of Setati and Adler (2001) who say that 2nd language English learners in South Africa, particularly those in the rural areas, only experience English at school and that this impacts negatively on their academic performance. Bongani suggested that his learners' lack of competence in English is rooted in the fact that the learners only start with English as the language of instruction in grade 4. He suggested that they should start in grade 1 with English and that would solve the problem. As noted already, this suggestion is not in line with much of the South African and international literature on the topic of $2^{nd}$ language English learning.

**Bongani's interview**

Despite this difficulty with language, Bongani chose to do word problems in all three lessons which were filmed. He described this as typical of his teaching. His use of the Instamaths textbook published by Maskew Miller Longman, which provides the teacher with a host of word problems backed up this comment. The word problems which Bongani chose, broadly covered basic operations with whole numbers as well as money and fractions to a lesser extent.

In his interview, Bongani spoke of his learners' difficulties with word problems and how not knowing the English can impact on their results in national assessments which he said asked a lot of questions in context. He pointed to the lesson where the learners did not know what a 'fowl' was and how it had derailed the lesson. He stated that their ability to do mathematical procedures was good but the learners struggled when questions were situated within a context. He said "It's something as a teacher I think I need to be developed on, because once I master that I know I will definitely make an impact".

Bongani also spoke about the importance of learners understanding what they were doing. He said,

> .. and it is only when you engage them by asking them how and why, that's when you feel at the end of the lesson yes, about 2, 3, 4 children understand exactly what's happening but if as a teacher you're just interested in answers that's where you're running a risk of losing everyone.

He also explained that he asked learners for their thinking in order to "eliminate guesswork". He showed concern that his learners tended to guess what to do, but also expressed doubts about his way of handling it, as seen in the following quote:

> I'm afraid some get easily intimidated even if they know the answer because they know there'll be a why and what and they decide not to answer. I don't know how I can try and eliminate that because sometimes I can see this child has an answer but they're not confident to raise their hands because they know they will have to – so in the process you only get those average and above average children to participate in the lesson so that is one of the weaknesses of my approach – but how, I don't know how to get everyone on board?

In relation to a question about repeating what learners have said, Bongani had definite opinions expressed in the following exchange:

> B: Yes, when I started I will do it unconsciously but later on I realised that it is very important for me to reiterate or repeat what the child has said in order for that very child to internalise and for the other children that might have not heard or understood, to benefit. I ask a child to read the question or the instruction and the child will read and before we can interact with the question, I repeat the question and that way I think I'm helping the children to internalise because some are not even listening and even the very same child might have read just for the sake of reading but when I repeat it then they start thinking this is very important and they listen so they're not hearing the word for the first time, they heard it twice or three times in a lesson which I think it's a very good idea and it works.
>
> J: So you're doing it for the benefit of the learners. Do you think it's for the benefit of the learners because its 2nd language English or would you also do it with English speaking children?
>
> B: I will still do it with English speaking children but I wouldn't overemphasise like I'm doing with the…

This exchange highlights how Bongani viewed the repeating aspect of the category of revoicing. His view of repetition to stimulate engagement aligns with the notion of revoicing in order to keep the idea on the table (O'Connor & Michaels, 1993; Brodie, 2008). Repeating can be used in more ways than just repetition of the question e.g. repetition of a conjecture made by a student so as to give other learners a chance to interact with the idea.

**Refiloe**

Refiloe grew up in Soweto as a Xhosa speaking child but also learnt isiZulu and has a good command of English. She completed a Senior Primary Diploma at the Soweto College of Education in 1995 and has taught in both a primary and high school up to matric level. She is currently studying with UNISA for an Honours degree in Inclusive Education. In her interview she mentioned that she had taught in a high school before coming to her current post and that this had given her an understanding of what the learners needed to know.

> I taught at high school before and in most cases we found the learners lack the mathematical concepts, the right concepts to use, so I'm coming with that experience to primary. In most cases I do extend them a little bit further but... I'm pro-Maths and

> I want them to know that mathematics is a science on its own and it has got its own specific terms, its own terminology.

This statement links to Adler & Setati's (2001) model *fig 2* shown in chapter 2 where teachers support learners in various ways as they move from informal to formal mathematical discourse. Terminology as pointed out by Moschkovich (1999) is only one aspect of mathematical discourse but an important one, nevertheless.

Refiloe gave an example of how she supported her learners who were curious to know more than what was required by the curriculum. She had an impressively well resourced and organised mathematics classroom. Her walls and backboards were covered with all kinds of printed mathematics posters, mostly reminders of rules and procedures which grade 6 learners are expected to know or be learning. Her learners sat comfortably in groups around 2 tables fitted together into hexagonal shapes.

When asked about her learner's language profile, she said that there were two groups of students who were English speaking, a few from foreign countries and those of Indian descent. The rest of her learners spoke many different African languages. Refiloe said that the 2nd language English speakers were only disadvantaged for about 2 terms if they came to the school in the higher grades. Those learners who started at the school in grade R or grade 1, she felt, were not disadvantaged. This view is similar to Bongani's idea that learners should start with English in grade 1. It was apparent as an observer that most of the class were competent in the use of conversational English. Most of her learners answered questions using well structured sentences and there was a lot of participation in her lessons. She stressed that she was very committed to "inclusion" in her classes, wanting all her learners to succeed. This statement resonates with Lave & Wenger's notion of "access to the learning potential of a situation" in that Refiloe wants all her learners to have access to what is being learned in the classroom. There was also a high degree of participation in her classes which supported her commitment to inclusion.

**Refiloe's interview**

When asked what strategies she uses to help learners develop the mathematical concepts, Refiloe stated:

> R: In most cases I start from the known to the unknown for e.g. If I'm teaching them properties of 3D shapes and I want them to identify the vertices I will start using the word corners and the sides and then introduce the correct words so in future they don't say "the corners" but they say "vertices".

J:OK so are they more likely to understand corners

R: They're more likely and what I've seen is if you keep on referring to corners when the question comes and it says vertices there, most of them will have a problem so if you instill the correct concept in them in most cases you won't have a problem. You will still have a problem there and there but the majority will still remember it.

This excerpt would be coded as an "into maths language" move as Refiloe is talking about moving from everyday into mathematics terminology, from informal into formal. What is interesting is that she is not only revoicing learners' informal statements but introduces concepts herself using informal or everyday language and then moving it into a more formal realm.

To test for learner understanding of concepts, Refiloe had this to say:

R: I'd normally say to them "Just explain. If your younger sister or younger brother in a lower grade asks what do you mean by a certain... like what is a remainder or what are vertices, what are you going to say to them? " Then I'll be able to see if they do understand the concept, they can identify it with day to day life.

In this case, Refiloe encourages her learners to rephrase a formal concept in a less formal way so that she can tell if they really understand it.

An example of moving from formal to informal as well as the use of gesture, is exemplified in the next exchange – based on an excerpt from the video transcript that was discussed during the interview:

J: Lets look at the following exchange

*R: What type of sides or what type of lines are parallel lines?*

*L: lines that are next to each other but never meet*

*R: lines that run next... opposite each other but will never meet (gestures with her arms).*

J: Then you elaborated on... you were showing them which ones were parallel. Were you elaborating on this, I don't know if you can remember?

R: I think I was elaborating.

J: So when you elaborate is that for the rest of the class?

T: For the rest of the class, yes. Basically for the rest of the class and then even for my weaker learners.

This is an example of Refiloe's stated commitment to inclusion, getting all her learners to understand. Her use of elaboration is coded as rephrasing into mathematical language. The reverse type of elaboration (from formal to informal) was not included as a category as it was hardly used during the three lessons, but stands out as part of her practice as a way to support learners, and is an expression of Pimm's model, *fig 1,* which I outlined in chapter 2.

Refiloe also shows concern for moving the learning forward as expressed in the quote below which follows on from the above extract:

R:.... you move those who can, you're moving them forward rather than holding them back because of weaker learners.... but it's very difficult to manage

It's either you move forward quickly with those that can grasp the concept and you forget about the others, or, you actually try to bridge and the others tend to be bored and everything because you're trying to bridge the gap between the (inaudible)

The following exchange points to the extent of planning and preparation which Refiloe is involved in before a lesson. It also suggests that tight planning can have a constraining effect on learners thinking.

J: You seem to know where you're going... mathematically you seem to know - I want to get to this point, this is my plan... and your worksheets and handouts are aimed in that direction. To what extent do conversations with learners send you on a different track?

T: With maths its... they do not derail me that much because whatever the discussions that are going to come up is going to be linked to the concept so with mathematics it's not easy for them to derail me...

Refiloe interpreted the question as learners trying to derail her which has a negative connotation. Perhaps a slightly less tightly controlled and more open agenda where learners are encouraged to come up with their own ideas, explanations, solutions and justifications (NCS, 2002) could make her lessons mathematically richer. On the other hand, Refiloe said that "discussions that come up will be linked to the maths concept" unlike in other classes she teaches where learners deliberately try to move away from the topic. Here she is acknowledging that discussions are usually mathematically connected to the topic and therefore not necessarily a waste of time. This suggests a confidence with handling mathematical ideas expressed by learners in different ways and at different levels.

Although, not really conscious of the way she was using repetition, when asked about it Refiloe described it as a way to affirm her learners. This supports the use of "affirm" as one of the repeating moves in my coding model (*fig 8*).

> J: OK so now... I want to talk to you about repetition because I notice that there are 2 main things that you do. Earlier on we were saying that you elaborate so sometimes you're elaborating on what a learner says and other times you repeat it in the same way as the student said it so it's obviously a strategy that you use. I'm not sure if you're conscious of it – often we're not conscious of our strategies but this is of great interest to me (R laughs)
>
> R: Yes I must say at times its just for... at times I'm unconscious of like repetition... at times I use it as an affirmation ... you know because at times a child will answer you and look like doubting and I've seen when you actually use the learners words, word for word, they get that sense of affirmation and they feel "you know what, I've answered the way the teacher wanted". To them it means a lot, but at times it just happens unconsciously, I'm not even aware of it.

When asked about the use of rephrasing, the discussion went as follows:

> J:... and then the other strategy you seem to use is rephrasing what they've said if it's not quite right
>
> R: It depends... I do not like to shut them down. You know when we grew up we always had this thing that mathematics was difficult and teachers that teach mathematics, you cannot be friendly with them. Ja, there was that attitude between the teacher and the learners.
>
> J:Distance
>
> R: Ja distance.. so unlike with life orientation and all these other subjects where you

> can engage in a discussion, I would rather say "OK  alright but who has an alternative answer to that and then link the two and try to find something that is (laughs) common or correct it but in a way that doesn't shut the child down.

This strategy described by Refiloe occurred twice during lesson 1. Her description reflected the original way of looking at revoicing proposed by O'Connor & Michaels (1996) which is to orchestrate discussion by positioning learners in relation to each other and the mathematics. When Refiloe asked for an alternative answer and then tried to link the two, she was orchestrating discussion and trying to find common ground between learners. This showed an awareness of rephrasing in this way and therefore, the potential for Refiloe to use revoicing in more sophisticated ways including those closer to the literature than was observed during the rest of the lessons.

By saying that she did not like to shut the child down, Refiloe was indirectly expressing her commitment to supporting her students, building them up to be confident, unlike her own experience of maths teachers at school whom she described as distant. This links back to her commitment to inclusion.

## MOVING FROM TEACHERS' VIEWS TO MY OBSERVATIONS

Before presenting my findings in relation to revoicing practices, I will give an overview of the teachers' lessons. I will discuss the aim and the sequence of the lessons. This will be followed by a more detailed focus on the trends and patterns used by the two teachers in the way in which they give feedback to their learners.

### Bongani's lessons

Each lesson followed a similar format. Class started every day with a short tables test. Learners knew their tables so it appeared affirming for them although pitched at a low cognitive level (Stein et.al., 1996).  The lesson continued with a learner being asked to read one of the word problems which had been done for homework. Bongani then took the lead using the IRE/F format for most of the lesson. He responded to each of his learner's utterances with another question asking the learner to explain how they arrived at an answer. If he sensed that his learners were lost, he stopped the lesson and suggested that they work in groups for a while. During this time he went round interacting with the groups in a similar way to how he ran whole class interaction. When he was satisfied that the learners had gained more insight and that some of the groups had got the correct answer, he returned to whole class interactive teaching.

**Lesson 1** began with the word problem "*Mr Smith bought a car for R2 980 and paid a quarter of it in cash. How much did he still owe?"* What was interesting is that his learners had correctly divided R2 980 by 4 and got R745 but when asked why they divided by 4, their answer was "so that I can get R745". Bongani had extreme difficulty in explaining the sequencing of the question to the learners; that R745 was the result of dividing by 4, not the reason for dividing by 4. This took an unnecessary length of time so that the lesson was over by the time they started to work on a second problem "*The tyre of a tractor costs R247, 84. How much will three such tyres cost?*" There were also difficulties which arose due to Bongani's use of the comma as a marker of thousands (American use) as well as for decimals resulting in the learners reading R247, 84 as two hundred and forty seven thousand eight hundred and forty. This problem was never sorted out.

In **lesson 2**, Bongani followed the tables test with the following question "*A train arrives at ¼ past 12 instead of 5 minutes to 12. How many minutes late is it?*" Bongani repeated the question over and over again when he saw that learners were getting incorrect answers. He also narrowed the type of answer which he was expecting from the learners which also slowed down the progress of the lesson. He then returned to the first question from lesson 1, again finding it difficult to clarify learners' difficulties but managed to complete the word problem and began a new one "*8 horses and a number of fowls have 40 legs together. How many fowls altogether?*" This question caused a lot of misunderstanding because learners didn't know what a fowl was. They mixed it up with foal and Bongani firstly didn't pick up on the problem for a long time and then required the dictionary to establish the difference between the two. Again, this problem wasted a lot of precious time and could have been anticipated.

**Lesson 3** was spent on only one question. "*Joan has two 50c pieces, five 20c pieces and ten 10c pieces in her money box. How much money has she?*" The learners got the answer right away, showing that the knowledge was in place, yet Bongani chose to explore how they got their answers by lengthy deconstruction of the question to the point of showing the class how to multiply 10 x 10 by long multiplication. A better use of time could have been made by extending the question rather than focusing on procedures.

**Refiloe's lessons**

Refiloe's **first lesson** was a hands on lesson revising 2D shapes and exploring 3D shapes. She began by eliciting information about 2D shapes from the learners in preparation for a task on 3D shapes. They explored the shapes, looking at the similarities and differences between the square, the rectangle, the parallelogram and the rhombus. She used 73 out of 286 turns to do in depth revision of 2D shapes, covering sides, right, obtuse and acute angles, parallel lines which led to the properties of parallelograms, squares, rectangles and rhombi. Most learners were able to get the correct answers to her questions, but the delay in order to think through the question suggested that the 2-D shapes work was revision, but pitched at a level that provided some challenge, enough to keep the class thinking.

After a few days we managed to film a **2nd lesson** which dealt with the procedure of division. Most of the lesson was preparing learners for the task which was to write a letter to a friend explaining how to do long division. The lesson was therefore focused primarily on the procedure and revising of the language associated with division. Refiloe managed however, to cover the concept of factors, checking division by using its inverse which is multiplication as well as the concept of place value, concepts which could be useful for their upcoming task. This illuminated the type of coherence which Refiloe brought to her lessons showing that the first half of the lesson would help her learners to participate in the rest of the lesson thereby increasing their motivation and engagement throughout.

Her **3rd lesson** built on lesson 2 by applying the division procedure to word problems emphasizing the terminology of division. This lesson was focused on a combination of operations involving division. Having taught grade 5 learners, I found that a combination of operations was particularly challenging for learners when embedded in a word problem, a view shared by Bongani. She began with a mental test with questions in the format of $24 \div (3+9)$ preparing the learners for the fact that they would need to do this in the rest of the lesson.

**REVOICING AND NON-REVOICING FEEDBACK PRACTICES**

In the next section, I will examine the teacher's use of revoicing and non-revoicing practices, focusing only on the teacher moves during teacher turns. Learners may also revoice when called upon to do so by teachers or when working in their groups but my study is focused on the teacher's use of the practice. As explained in Chapter 2, revoicing and non-revoicing moves are subsets of teacher feedback (F) in the IRE/F structure which involves a back and forth (much like a tennis rally) taking of turns in asking questions, responding and then giving feedback.

I begin this section with an outline of what counts as a feedback move in my analysis. This is followed by *fig 10* which gives a broad overview of which feedback moves were used the most and the least by each teacher in my sample. This summary helped me to see what types of revoicing were more common and what proportion of the lessons was spent on revoicing or non-revoicing feedback.

This broad summary will then be followed by *fig 11* which provides a detailed picture of the raw data in coded form. Although we can't generalise from this, we can see what the two teachers were already doing, and in which ways they used repeating or rephrasing to support their learners' appropriation of mathematical Discourse. This information may enable us to start thinking about ways to improve feedback through revoicing in purposive ways.

**What Counts as a Feedback Move in my Coding Model?**

Below I detail what counts as a feedback move in my coding model. Each of the categories is described and is then followed by examples of the different moves found in my data. As noted in Chapter 2, I make a distinction between feedback moves which are non-revoicing and those which are revoicing.

Table giving a description of each feedback move

| Type of feedback moves | | Description of the feedback move |
|---|---|---|
| Non - revoicing feedback moves | Revoicing feedback move | |
| Elicit | | Teacher asks a question related to the ongoing discussion to elicit information or answers. |
| | Affirm | Teacher repeats the learner's answer to let him/her know that it was correct. |
| Insert | | Teacher offers more information related to the ongoing discussion. |
| Press | | Ask learners for reasons for an answer (starts with why or how). Often asking for procedural answers. |
| | Access | Repeating an idea so that learners get more time and hear it again so that they can think about it for longer and understand it better |
| | Deconstruct | Opening up an idea using rephrasing to make it more accessible to learners |
| | Into Maths language | Teacher transforms a learner's utterance. e.g.Teacher gives the term 'parallel' in response to learner talking about lines which go 'next to ' each other. |
| | Written | Using the board to represent what is being discussed. |
| | Funnelling | Narrowing a question by closing learners' options to give anything other than a correct answer |
| Confirm | | Teacher checks with the learner if she has heard or understood correctly what the learner had said. (starts with so...) |
| | Into correct English | Correcting a grammatical or vocabulary aspect of what learner has said. |

*Fig 9*

In an excerpt from Bongani's second lesson we see the use of several feedback categories. The question in lesson 2 was "*8 horses and a number of fowls have 40 legs together. How many fowls altogether?*"

| turn | move | Teacher speaking | Learner(s) speaking |
|---|---|---|---|
| 199 | Elicit | If 8 horses have got 32 legs altogether where do you get the 8 legs | |
| 200 | | | Fowls |
| 201 | Affirm<br>Funnel | Fowls. Ja, we need 8 legs from the fowls so how many fowls | |
| 202 | | | 4 |
| 203 | Access | We're gonna have 4 cause a fowl has 2 legs | |
| 204 | Written | We say 4 x 2 = 8 *on the board* | |
| 205 | Insert | So we know the number of horses is 8 and the number of fowls here is 4 | |

From Refiloe's first lesson we see an example of initiating, eliciting information followed by deconstructing to give the learner access to something she was finding difficult.

| turn | move | Teacher speaking | Learner(s) speaking |
|---|---|---|---|
| | | | |
| 263 | Initiate<br><br><br>elicit | *K.. has drawn a 3D shape for the side view – T trying to help her to see that you can only see a 2D shape*<br>T: K.., the rectangular prism from the side do you see it as a 3D shape ....... or... do you see it as a square | |
| 264 | | | K..: from the side mam |
| 265 | Deconstruct<br><br><br><br><br><br><br>elicit | T: OK this (*pointing to K.'s answers*) was your bird's eye view, so it was a rectangle. From the front (turns the box and points to the front of the box) its OK. From the side do you see it as a 3D when you look at it from the side (*T turns the box so that the side is facing K..)* this was your side – if you were to come this side and look at it from the side would you still see it as a 3D shape. | |

The next excerpt from the same lesson shows Refiloe helping learners with both " correct English" and "mathematical language". We also see an example of evaluation and examples of the way Refiloe "affirmed" and immediately followed it with "elicit".

| turn | move | Teacher speaking | Learner(s) speaking |
|---|---|---|---|
| 201 | English language | T: Is it a rectangle prism or a rectangular prism | |
| 202 | | | Chorus: rectangular |
| 203 | English language | *Teacher going around helping learners to see what's expected – she says "from the bottom , from the top, from the side....* | |
| 204 | Initiate<br><br><br><br><br>Maths language elicit | T:Let's mark the first excercise. You're going to write your items differently but you just look at your grid where you've written the items. We'll start with shoe box. Geometric name of a shoebox? | |
| 205 | | | L: rectangular prism |
| 206 | Affirm + elicit Maths language | T: rectangular prism. Number of faces,... G | |
| 207 | | | G: 6 faces |
| 208 | Affirm+ elicit Maths language | T: 6 faces, number of edges. M..? | |
| 209 | | | M: 8 |
| 210 | Affirm but incorrect | T: 8 | |
| 211 | | | Lrs: no no |
| 212 | Insert Elicit Maths language | T: sorry, number of faces (*should be vertices?)* is 8 number of edges, P | |
| 213 | | | Prince: 12 |
| 214 | Affirm+ elicit | T: 12 Type of faces that you see .. O | |
| 215 | | | O: square and rectangle |
| 216 | Elicit | T: How many squares | |
| 217 | | | O: 2 squares and 2 rectangles (muttering from the class) I mean 2 squares and 4 rectangles |
| 218 | Evaluate Elicit Maths language | T: K 2 squares and 4 rectangles. Good. The toblerone. Geometric name? C | |
| 219 | | | C: Triangular prism |

We can see in this excerpt that many of the teacher turns produced several different feedback moves e.g. turn 208 was coded with three moves, affirm (repeated the learners answer of 6), elicit and maths language by asking “number of edges?”.

Another example of this use of a turn for multiple moves is when a teacher uses the board which might be coded as a repeating move, serving the purpose of access as well, and would therefore be coded as written and as access. The board can be used for both repeating and rephrasing but in my data I found it was used mostly as repetition. A teacher might insert an idea to give better access to the learners thereby increasing their mathematical understanding of a question. It would then be coded as insert (non-revoicing) and as access (revoicing).

In *Fig 10,* I describe the number of times each feedback move was used from the most used to the least used categories. The teacher moves have been separated into non revoicing and revoicing in order to see which was used more than the other. I have shaded the revoicing moves in the table for easier reading. Of the revoicing moves I have shaded the repeating moves with a darker shade and indicated which is a repeating move (Rep) and which is a rephrasing move (Reph).

Table showing extent of the use of different feedback moves

| Type of feedback moves | Number of times the moves were used by Bongani | Number of times the moves were used by Refiloe | Total |
|---|---|---|---|
| Elicit | 111 | 145 | 256 |
| Affirm (Rep) | 39 | 160 | 199 |
| Insert | 55 | 39 | 94 |
| Press | 49 | 16 | 65 |
| Access (Rep) | 43 | 16 | 59 |
| Funnelling (Reph) | 34 | 18 | 52 |
| Into maths language (Reph) | 10 | 35 | 45 |
| Deconstruct (Reph) | 13 | 16 | 29 |
| Written (Rep) | 10 | 16 | 26 |
| Confirm | 12 | 0 | 12 |
| Into correct English (Reph) | 6 | 4 | 10 |
| TOTALS | | | 847 |

*Fig 10*

The table above, *fig* 10, seems to suggest that, with the exception of “revoicing to affirm”, revoicing moves were less prevalent than the non-revoicing moves. In fact the same number of moves were used for revoicing and non-revoicing feedback. However, a good number of rephrasing moves were taken up by funnelling which has been explained in chapter 2 as an unproductive move. This is significant in terms of the type of discussions which are happening in these classrooms. Besides the negative aspects of funnelling, affirmation falls within a model of teaching as judgment rather than learners developing the tools to explain and justify their ideas themselves (NCS, 2002; NCTM standards, 1989). After the elicit and affirm moves, the next most common moves, insert and press, were both in the non-revoicing category. The rest of the revoicing moves were on the lower end of the table and therefore, with the exception of "confirm", have the lowest counts in the table. If we separate the 420 revoicing moves into repeating and rephrasing we find the following. Of the revoicing moves, 254 were "repeating of students' utterances" and only 136 revoicing moves fell into the broad category of "rephrasing", 52 of which were funnelling. This means only 84 of the rephrasing moves were considered productive. I will show later in this chapter that the potential for improved feedback (Brodie, 2010) lies within the rephrasing category.

**Presentation of the raw data in detail**

I go on now to provide a detailed picture of the raw data collected from the actual lessons

In *fig 11* on the next page, we can see the real number of feedback moves devoted to particular revoicing or non- revoicing feedback moves .The revoicing moves have again been greyed out for easy reading. The table also includes the total number of turns per lesson (1391 including learner responses) and the total number of teacher turns per lesson.

I have included a second layer which presents the same information but as a % of teacher moves spent on the various forms of feedback. This layer is placed in the row immediately below the number of moves for each category.

In order to read the overall summary data, the mini table below explains how to read *fig 11*. B1, B2 and B3 in the top row stand for Bongani's 1st , 2nd and 3rd lesson. Initiate on the left shows the type of move. Bongani therefore initiated 3 times in lesson 1, 9 times in lesson 2 and 10 times in lesson 3. In the next row we can see that those 3 initiating moves constitute 2,9% of a total of Bongani's 101 teacher moves in lesson 1 whereas in lesson 2, 6,6 % of a total of 121 of his teacher moves were used to initiate.

Mini table showing how to read the large table, *fig 11*, below**.**

| | **B1** | **B2** | **B3** |
|---|---|---|---|
| INITIATE | 3 | 9 | 10 |
| As a % | 2,9% | 6,6 | 4,6 |

Coding framework showing  the raw data for each teacher per lesson

| | | | BONGANI | | | | REFILOE | | | | total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **IRE/F** | | | **B1** | **B2** | **B3** | **total** | **R1** | **R2** | **R3** | **total** | |
| Initiate (I) | | | 3 | 8 | 10 | 21 | 25 | 12 | 26 | 63 | 84 |
| As a % | | | 2,9 | 6,6 | 4,6 | | 9,8 | 6,5 | 24,3 | | |
| Respond (R) | | | | | | | | | | | |
| Evaluate (E) | | | 12 | 12 | 13 | 37 | 11 | 5 | 2 | 18 | 55 |
| As a % | | | 11,9 | 9,9 | 6 | | 4,3 | 0,27 | 1,9 | | |
| Feedback (F) | **(total feedback moves)** | | **86** | **101** | **195** | **382** | **218** | **168** | **79** | **465** | **847** |
| | Press | | 12 | 13 | 24 | 49 | 12 | 2 | 2 | 16 | 65 |
| | As a % | | 11,9 | 10,7 | 11 | | 4,7 | 1,1 | 1,9 | | |
| | Elicit | | 21 | 23 | 67 | 111 | 57 | 74 | 14 | 145 | 256 |
| | As a % | | 22,8 | 19 | 30,7 | | 22,4 | 31,2 | 13,1 | | |
| | Confirm | | 9 | 3 | 0 | 12 | 0 | 0 | 0 | 0 | 12 |
| | As a % | | 8,9 | 2,5 | 0 | | 0 | 0 | 0 | | |
| | Insert | | 5 | 15 | 35 | 55 | 12 | 15 | 12 | 39 | 94 |
| | As a % | | 5 | 12,4 | 16,1 | | 4,7 | 8,1 | 11,2 | | |
| | Subtotal | Non-rev feedback moves | | | | 227 | | | | 200 | 425 |
| | | As a % | | | | 51,6 | | | | 36,6 | |
| | Maintain/ Revoice | **REPEATING** | | | | | | | | | 286 |
| | | For access | 10 | 24 | 9 | 43 | 9 | 3 | 4 | 16 | 59 |
| | | As a % | 10 | 19,8 | 4,1 | | 3,5 | 1,6 | 3,7 | | |
| | | To affirm | 9 | 8 | 22 | 39 | 75 | 59 | 26 | 160 | 199 |
| | | As a % | 8,9 | 6,6 | 10,1 | | 29,5 | 31,9 | 24,3 | | |
| | | Written as is | 5 | 2 | 3 | 10 | 6 | 9 | 1 | 16 | 26 |
| | | As a % | 5 | 1,7 | 1,4 | | 2,4 | 4,86 | 0,93 | | |
| | | **REPHRASING** | | | | | | | | | 136 |
| | | Into correct English | 1 | 5 | 0 | 6 | 4 | 0 | 0 | 4 | 10 |
| | | As a % | 1 | 2,4 | 0 | | 1,6 | 0 | 0 | | |
| | | Into mathematical language | 6 | 3 | 1 | 10 | 25 | 3 | 7 | 35 | 45 |
| | | As a % | 5,9 | 6,6 | 0,45 | | 9,8 | 0,01 | 6,5 | | |
| | | Deconstructio n | 8 | 3 | 2 | 13 | 11 | 3 | 2 | 16 | 29 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | As a % | 7,9 | 0,8 | 0,92 | | 4,3 | 0,01 | 1,9 | | |
| | | Funnelling | 0 | 2 | 32 | 34 | 7 | 0 | 11 | 18 | 52 |
| | | As a % | 0 | 1,6 | 14,7 | | 2,8 | 0 | 10,3 | | |
| | subtotal | Revoicing feedback moves | | | | 155 | | | | 265 | 422 |
| | | As a % | | | | 35,2 | | | | 48,5 | |
| Total turns | | 1391 (includes learner turns) | 165 | 209 | 315 | 689 | 286 | 247 | 169 | 702 | / |
| Teacher turns | | 746 | 91 | 124 | 163 | 378 | 152 | 128 | 88 | 368 | / |
| Total teacher moves | | 847 + 139 = 986 | 101 | 121 | 218 | 440 | 254 | 185 | 107 | 546 | 986 |

*Fig 11*

In this table above, there are altogether 746 teacher turns. The reason for the total number of feedback moves (847) being different to the number of teacher turns (746) was dealt with earlier in this chapter showing that one teacher turn can produce more than one move at the same time.

Only 60 out of the 746 teacher turns were used for evaluation. The rest were devoted to some form of feedback move. I would therefore conclude that the teachers were using the IRF structure most of the time and IRE was only used on occasion. In my coding there is however a fine line between IRF and IRE. The reason for this difference is that I coded “affirm” as a feedback category because the teacher revoiced what the learner had said which let the class know that the learner’s answer was correct. Brodie (2010) would have coded this as “evaluate” but I make a distinction between these two categories as the one is a straight evaluation of good, no, or excellent while affirm was used extensively by Refiloe and less so by Bongani, as part of a revoicing practice. I therefore restricted those teacher responses which evaluate directly by beginning with the terms “good”, ”no” or “excellent” to the code “evaluate”. Brodie (2010) suggests that the IRE/F structure for whole class discussion can still be useful to teachers if we are able to improve on the kind of feedback given to learners. My analysis attempts to analyse the types of feedback that teachers are currently giving with a view to finding ways of building on existing practices to improve their feedback. My findings indicate that the use of revoicing within the IRE/F structure is already in use in my sample. I will show how Bongani used revoicing quite explicitly in the form of repetition in the hope that his learners would gain access to the understanding of the question. I found this form of revoicing lacking in that the learners who did not understand the term in English were still unable to understand it after several repetitions.

## MOST COMMONLY USED FEEDBACK MOVES

As mentioned earlier, there are the same number of non-revoicing and revoicing feedback moves. As a % of all teacher moves, this comes to approximately 43% for both revoicing and non-revoicing moves. In real terms it is 427 non revoicing moves out of 746 turns. Of the 427 non revoicing moves, 256 or 60% of the moves were used to “elicit”.

As “evaluate” is a category on its own within the IRE rather than the IRF structure, I do not include the initiate or evaluate turns in my detailed analysis as they are not forms of feedback.

I include another way to look at this information to help the reader see the amount of different feedback moves in relation to the total teacher moves of 986.

<u>Feedback moves in relation to total teacher moves</u>

| Non revoicing feedback moves | Revoicing feedback moves |
| --- | --- |
| 427 (43%) | 420 (43%) |
| Elicit | affirm |
| 256 (60%) | 202 (47%) |

*Fig 12*

The largest revoicing move which comprised the other 420 out of 986 moves, was ‘affirm’ which was used 202 times or 47% of the 420 revoicing moves.

Further breakdown of these totals showed that Bongani used non revoicing more than revoicing and that the opposite was true of Refiloe’s practice.

<u>Each teacher’s use of non revoicing and revoicing moves.</u>

| | Bongani | Refiloe |
| --- | --- | --- |
| Non revoicing feedback moves | 227 out of 440<br><br>(52%) | 200 out of 546<br><br>(37%) |
| Revoicing feedback moves | 155 out of 440 | 265 out of 546 |

| | | |
|---|---|---|
| | (35%) | (49%) |
| Moves which are not feedback | 13% | 14% |

*Fig 13*

Bearing in mind that a turn often consisted of more than one move, the commonly used turn was to "affirm" and then to "elicit" more information. I did not separate these into two turns as they were mostly joined as one turn by Refiloe who used this combination the most. An example of each teacher's use of "affirm" followed by "elicit" is given below.

**Example taken from Bongani's first lesson dealing with word problems.**

*<u>*Word problem*</u>: Mr Smith bought a motor car for R2980 and paid ¼ of the price in cash. How much did he still owe on the car?

| Turn | Move | Teacher/ Bongani | Learner(s) |
|---|---|---|---|
| 9 | | | Nk: Mr Smith still owes 2 thousand, two hundred and thirty five rands. |
| 10 | Affirm | 2 235 rands. That is very important, very very important. 2 235 is just a number OK? | |
| 11 | *Elicit* | *Teacher probes further...*<br>T: How did we get that 2 235.......... | |

Bongani, in this instance, gave emphasis to the affirmation and then used another turn to elicit.

In turn 22 below, it seems that Bongani wants to know which operation is used to get 2 235.

| Turn | Move | Teacher/ Bongani | Learner(s) |
|---|---|---|---|
| 19 | Elicit | Lets start with R2 235 and see how you got it. Who wants to show us what they did and please explain how you got the answer. | |
| 20 | Access<br>Elicit | Teacher reads out the question again. You are telling us it is R2 235 rands. How did you get it. | |
| 21 | | | No response |
| 22 | Insert<br>Elicit | Come on sisters *(talking to a group of girls)*, how did we get it? Did we subtract, did we add , did we divide,... | |

| | | | |
|---|---|---|---|
| | | hmmm ? how did we get it? | |
| 23 | | | Lu puts up her hand |
| 24 | | Yes Lu, you want to show us this | |
| 25 | | | *Lu comes to the board and writes 745 x4 in vertical formation and goes through the whole sum till she gets to 2980.* |
| 26 | affirm | So you have 2 980, different to what we have on the board – 2 235 | |

The question was completed during lesson 1 but the next day Bongani returned to it. He was still not satisfied that the learners had understood what they were doing.

| turn | move | Teacher | Learner(s) |
|---|---|---|---|
| 93 | | | Lu: You must try and find the ¼ |
| 94 | Affirm<br>Insert<br><br><br><br><br>elicit | That is the very first question, that is the first problem. You don't know what ¼ of 2980 is….. That is where you must start, your point of departure. What is this ¼ of 2980 so first thing before you can add or subtract you must find out what this ¼ is.<br>Once you know the answer what do you do. Once you know the ¼ of…. What do you do. Now we know the ¼ of 2980 is 745 what do we do? How does that help me to my answer? | |
| 95 | | | NK:You subtract the ¼ from 2980 |
| 96 | Access<br>Press | You subtract the ¼ from 2980<br>Why are you subtracting the ¼ from 2980. Yes I agree with you but why are you taking a ¼ off the selling price but why are we doing that?<br>Why are we taking it away? | |
| 97 | | | To know the ½ of 2 380 |
| 98 | Evaluate<br>Insert<br>Elicit | To know the ½? How does that ½ come in here? There's no ½ where do you get a ½? We know what the ¼ is - we did it yesterday. By dividing 2980 by 4. How does the 745 help us to the answer. | |
| 99 | | | *silence but some hands are up.* |
| 100 | Insert | I'm giving you 2 minutes. Discuss in groups. You see we got the answer yesterday but we | |

| | | | |
|---|---|---|---|
| | | don’t know how to get there and that worries me. To repeat the question?<br>How does it help us to get to the answer?<br>What is the role of the ¼? | |
| 101 | | | Its gonna help us to know which amount does Mr Smith still owe. |
| 102 | Affirm<br>Elicit | Yes, The last part I’m happy with it. You’re saying the 745 is gonna help you? | |
| 103 | | | Yes, Its gonna help us get the answer, the amount that Mr smith still owes. |
| 104 | Elicit | How does it help you to get the amount that Mr Smith still owes? | |
| 105 | | | *no response and teacher moves to front group*. |
| 106 | Elicit | Yes | |
| 107 | | | Lu: you subtract 745 from 2980 to see how much Mr smith still owes |
| 108 | Evaluate | Perfect. The only way we can know how much Mr smith still owes is by subtracting, by taking away the… | |
| 109 | | quarter. | quarter. |

Bongani used “affirm” and “elicit” quite extensively though it was interspersed with other moves in most cases. He ignored incorrect answers and delved deeper into correct answers instead, often deconstructing the questions. If a learner gave a correct answer, he would always ask why or how the learner had got that answer. Although at first glance Bongani seemed to be probing for conceptual understanding, much of his probing was in fact aimed at determining which mathematical operation was the correct one to use.

This type of probing is useful at a procedural level but does not require conjecturing or justification of learner thinking and is therefore less in line with the idea of orchestration of whole class discussion than it initially appeared to be. Understanding in Bongani’s classroom would appear to mean “understanding which operation is required in order to get the correct answer”. This teaching style backs up Setati’s (2005) finding that teachers for whom English is not a home language, use it for calculational discourse and use home language for conceptual discourse. Considering Setati’s (ibid) findings, it seems that the constraints on Bongani’s efforts to develop conceptual discourse were evident. In his interview he also stated that learners knew that if they gave an answer, he would expect them to explain what they did to get the answer. E.g. An example of how Bongani stressed this commitment is indicated below:

Learner: *I said 745* x *4*

Bongani:*How did you get 745.... and where does the 4 come from?*

Although this lesson is centred around the exploration of a word problem mostly at a procedural level, Bongani also tried at times to move beyond procedures. E.g. A learner goes through the algorithm of dividing 2980 by 4 and Bongani asks:

"*But why are you dividing by 4?"*

He was not suggesting that the learner shouldn't have divided by 4 but was trying to find out why she chose to divide by 4. Later in the lesson we learn that Bongani wanted the learner to say that the question asked for a ¼ of 2980 so he needed to divide by 4 showing an understanding of the relationship between division and fractions.

Sometimes the "affirm" move was implied by the way the teacher responded. An example of this is given below showing how Bongani moved on to ask a question related to the learners answer.

| turn | move | Teacher | Learner(s) |
|---|---|---|---|
| 118 | Response from learners | | Chorus: hundred |
| 119 | Affirm & elicit | T: Why is it a hundred, who can tell me, why is it 100 yes M.. | |

Bongani did not re-utter "a hundred" but asked why it was a hundred implying that the answer was correct but wanting to know why it was correct. As he stated in his interview, the learners knew that they would be expected to explain their answers. He expressed concern that this practice may in fact have inhibited learners from offering a solution to a question. Given the limited number of learners who took part in the discourse it would appear that Bongani was unable to support a broad swathe of his learners' attempts at appropriating the required discourse.

**Example taken from Refiloe's 2nd lesson dealing with division**

| turn | Move | Teacher/ Refiloe | Learner(s) |
|---|---|---|---|
| 24 | Insert | . OK. So we have to check. We have to divide first and then check if the answers are correct | |

| | | | |
|---|---|---|---|
| | Written | using multiplication. You’ve got 724 divided by 7. *Writes it on the board.*<br>OK. What do we call 724? B.., look this side. Concentrate. What do we call 724? W.. | |
| 25 | | | A dividend |
| 26 | Affirm<br>Elicit | A dividend.<br>What is a dividend? | |
| 27 | | | The number that’s being divided. |
| 28 | Affirm<br><br>Elicit | The number that we’re going to divide.<br>Right? What do you call 7? | |
| 29 | | | A divisor |
| 30 | Affirm<br>Elicit | A divisor.<br>What is a divisor? | |
| 31 | | | The number that’s going to divide the dividend. |

Refiloe’s use of “affirm” and “elicit” formed a double move within one turn. This particular double move in one turn was used to move the idea forward by eliciting information or another answer close to the current idea, thereby keeping it in the public realm for further exploration (Forman & Ansell, 2002). If a learner answered “divisor” and the teacher asked “What is a divisor?”, then the learners got a chance to think more about the concept of a divisor.

This type of revoicing however, differs from Forman & Ansell’s (2002) notion of revoicing in that most of Refiloe’s questions are closed questions and do not involve conjectures and justifications. A closed question reinforces the traditional acquisitionist idea of teaching that the teacher has all the knowledge and is transmitting it to the learners and is then the only one who can judge if the learners have acquired the knowledge through testing. This idea is challenged by the notion of learners in a “legitimate peripheral participative” relationship with the teacher (Lave & Wenger, 1991) where the teacher supports the learner’s development as they participate more and more in the mathematical processes as set out in the NCTM standards(1989). Revoicing is the suggested way (Moschkovich, 2002; Setati & Adler, 2001; Lampert & Cobb, 2003) for teachers to give this ongoing support.

There are times when the teachers in both classes did things which I might not agree with, or they ignored things which I thought were important to deal with. I have chosen not to deal with these unless they impacted on the revoicing feedback categories in my coding model. For example, both teachers tended to ignore learner misconceptions which could have provided rich opportunities for exploration through revoicing. In particular, Bongani elicited answers from the learners, ignored the incorrect ones and chose to explore or deconstruct the correct answers. There is much literature (Nesher, 1987; Borasi, 1994), which suggests that incorrect answers have their origins in perfectly logical misconceptions and recommend that teachers explore them. Revoicing may be one of the ways to help us explore this area but it is beyond the scope of this study.

**WHAT OTHER REVOICING FEEDBACK MOVES DO THE TEACHERS USE?**

In this section I will point to excerpts from the lessons which highlight other types of revoicing feedback which the teachers are providing. In the table below, the numbers in bold indicate which feedback moves were most prevalent and in which lessons they occurred.

Bongani: % teacher moves of total teacher moves per lesson

| IRE/F | | | B1 | B2 | B3 |
|---|---|---|---|---|---|
| INITIATE (I) | | | 2,9 | 6,6 | 4,6 |
| EVALUATE (E) | | | 11,9 | 9,9 | 6 |
| FEEDBACK (F) | (total teacher moves) | | | | |
| | Press | | 11,9 | 10,7 | 11 |
| | Elicit | | **22,8** | **19** | **30,7** |
| | Confirm | | 8,9 | 2,5 | 0 |
| | Insert | | 5 | 12,4 | **16,1** |
| | Maintain Revoice | REPEATING | | | |
| | | For access | 10 | **19,8** | 4,1 |
| | | To affirm | 8,9 | 6,6 | 10,1 |
| | | Written as is | 5 | 1,7 | 1,4 |
| | | REPHRASING | | | |
| | | Into correct English | 1 | 2,4 | 0 |
| | | Into mathematical language | 6,6 | 6,6 | O,6 |
| | | Deconstruction | 5,9 | 6,6 | 0,45 |
| | | Funnelling | 0 | 1,6 | 14,7 |
| Total turns | | 1391 | 165 | 209 | 315 |
| Teacher turns | | 746 | 91 | 124 | 163 |
| Total teacher moves | | 986 | 101 | 121 | 218 |

*Fig 14*

In general, Bongani used short exchanges of IRF and his lessons were not tightly controlled. Although he used mostly the non-revoicing categories of “elicit” and “insert”, he also made use of revoicing by repeating, to give access to his learners. 19,8% of his 121 moves for lesson two were coded as “access” and 14,7% of the moves in lesson three were coded as funnelling. In his interview, Bongani indicated he was aware that his students struggled to understand the word problems and that he used repetition to mitigate against this problem. This idea resonates with Lave & Wenger’s (1991) statement that it is important to give learners “access to the learning potential of a situation”. Without understanding the language, a learner was denied access to the learning potential of the task at hand. His strategy of repeating the question over and over again, was to a large extent ineffective with evidence that learners continued to misunderstand the question. Research suggests that some form of rephrasing of the question or even code switching might have been more effective (Setati & Adler, 2001).

**Bongani revoices by repeating**

In the excerpt which follows, we see how Bongani used repetition, repeating the question 5 times within 23 turns (including learner responses) with learners still not understanding. Although he cited access to English as a serious problem for his students, Bongani did not check to see that his learners understood the word problem. He seemed to take the access to the English language for granted and only realised in turn 147 that the learners did not understand the meaning of the word ‘fowl’.

Bongani lesson 2: Repeating for access

| turn | Feedback move | *Teacher* | Learner(s) |
|---|---|---|---|
| 124 | Access | *Asks learner to read the question* | 8 horses and a number of fowls have 40 legs together. How many fowls altogether? [first time] |
| 125 | Access | *Teacher reading slowly*: 8 horses and a number of fowls have 40 legs together. How many fowls altogether? How many? [second time] | |
| 126 | | | Lrs*: inaudible mutterings* |
| 127 | | hm? | |
| 128 | | | *Learner comes from another class to report that they are without a teacher and making a racket.* |
| 129 | Access | 8 horses and a number of fowls have 40 legs together. How many fowls althogether? [third time]<br>OK I’m giving you 2 minutes to | |

| | | | |
|---|---|---|---|
| | | discuss with your friends. Oh you've got the answer already. Share with your friends. Give them a chance to come up with their answers and debate it ne. (teacher rushes out to attend to the other class.) | |
| 130 | | | Learners discuss animatedly while waiting for the teacher to return. |
| 131 | Initiate | *Teacher with group*. What is zero | |
| 132 | | | Zero from the 40 |
| 133 | | | They get 8 fowls |
| 134 | Insert | *Teacher refers back to the question and says* "so you can't get 48" | |
| 135 | Deconstruct√ | The number of legs is given, its 40. They all have 40 legs | |
| 136 | Elicit | We've got the number of horses so how many fowls are there? | |
| 137 | | | *Another group*.<br>Sir, we got 20 fowls |
| 138 | Access<br><br>Insert | *Rereads the question to the group.* [fourth time]<br>40 is given, you cannot go beyond 40. We have the number of horses but we don't have the number of fowls. So how many fowls do we have? | |
| 139 | | | *Inaudible*….. |
| 140 | Ignores | Hmm? | |
| 141 | | | Yes |
| 142 | Confirm | So its 20 fowls | |
| 143 | | *Smiling and moves on to another group* | Yes |
| 144 | Elicit | Your answer is? | |
| 145 | | | 48 |
| 146 | Insert | 48. (To the class)You don't seem to understand the question . A.., read the question again for us. | |
| 147 | Access | | Reads the question [fifth time] |

Bongani also used repeating what a learner said, to affirm the learner. This is seen in the excerpt below.

**Word problem*: Mr Smith bought a motor car for R2980 and paid ¼ of the price in cash. How much did he still owe on the car?

Bongani lesson 1: Repeating to affirm.

| turn | Feedback move | Teacher | Learner |
|---|---|---|---|
| 118 | Evaluation<br>Elicit | Excellent..... *goes to the board, points at the 2235 and says something is lacking here*. What are we short of. There's something that he didn't write here | *Learner has written 2235 on the board.* |
| 119 | | | The comma |
| 120 | Written<br>elicit | The comma? Where, there, here, here? | |
| 121 | | | Between the 2 and the 3 |
| 122 | elicit | Come again | |
| 123 | | | Between the 2 and the 3 |
| 124 | Confirm | Here | |
| 125 | | | No. Between the 2 and the 2 |
| 126 | Insert | Is it a comma that we're looking for? *(tries to encourage the boys to answer.)* | |
| 127 | | | The R |
| 128 | Affirm + elicit | The R for rands (*writes it in on the board) points to the 2 options for answers R2,235 and R1,490* ) meaning our correct answer between the two is | |
| 129 | | | the top |
| 130 | Affirm | the top answer R2 235 and that is the outstanding amount meaning what Mr Smith still has to pay for the car. Alright? He has spent R745 already. The 2 235 is outstanding. Now, we have answered our question. | |
| 131 | Elicit | Tell me how many operations did we use there. To get to the answer, how many? | |
| 132 | | | 4 |
| 133 | | *(Ignores this answer)*. Yes K... | |
| 134 | | | 2 |
| 135 | affirm +elicit | 2 yes its what and what? | |
| 136 | | | L: subtraction |
| 137 | Affirm | T: yes we've subtracted and | |
| 138 | | | L: divided |
| 139 | Affirm | We have divided<br>Remember when I said some word problems will ask for more than 1 | |

| | | | |
|---|---|---|---|
| | | operation so we have divided and we have subtracted. All happy | |
| 140 | | | Yes |

**Bongani revoices by rephrasing**

Bongani used revoicing in several ways in this lesson. In the question where Mr Smith is buying a car for R2980, paying ¼ of it and then learners were asked how much he still owed, most of the revoicing fell into the repeat category but when a learner said they are still looking for the price, Bongani rephrased it as “the amount of money that is still owed” and followed up with “How do we get the outstanding amount?” which further rephrased the concept.

| turn | Feedback move | Teacher | Learner |
|---|---|---|---|
| 80 | Elicit | What are we still looking for? We’ve got now the money or the selling price that Mr Smith had paid for the motor car. We’re still looking for something. Now we have the ¼ *(pointing to the 745 on the board*) What are we still short of? | |
| 81 | | | We’re still short of the price he still owes. |
| 82 | Into correct English | He’s still short of the amount of money that is owing on the motor car. Now how do we work that out?<br>We’ve got the ¼ we know what he’s paid, now how do we get the outstanding amount? .... | |

The learner’s response indicated some understanding of the question but she didn’t have the English to express it properly. She may have used the word price because it had been used in the previous turn as selling price and to her it signified an amount of money owing or ‘an owing price’.

By rephrasing the concept “price he still owes”, Bongani was giving the correct way of saying what the learner was trying to express.  Bongani made specific the fact that “owed money” was for the “motor car” and vocabulary was extended to include “outstanding amount”. I coded this interaction as rephrasing into English.

Bongani also used opportunities to consolidate mathematical terminology.

| turn | move | Teacher | Learner(s) |
|---|---|---|---|
| *65* | Elicit | 745 What do we call that 745 – What do we call the answer when we divide. What is 745? There's a name for this 745 when you do division. *(puts a circle around the 745 on the board).* What do we call it? | |
| *66* | | | a remainder |
| *67* | Repeats word<br>Evaluates | Is it a remainder? This 745. It can't be a remainder. A..? | |
| *68* | | | Sir it is called the quotient |

In turn 65, Bongani focused on terminology by trying to elicit the correct word from the learners. In turn 67, he revoiced by repeating the word remainder in the form of a question which let the learner know that it was not correct and then rejected the answer.

**Lesson 2 deals with the concept of time.**

**Word problem*: A train arrives at ¼ past 12 instead of 5 minutes to 12. How many minutes late is it?

The teacher elicited mostly incorrect answers from the learners as he went from group to group. Bongani's reponse to wrong answers involved revoicing by repeating the question 5 times and showing surprise that learners were still misunderstanding the question. One learner drew the clock to help her understand which Bongani used later by drawing it on the board. Below is an exchange with a group which had the correct answer.

| Turn | Category | TEACHER | LEARNER(s) |
|---|---|---|---|
| *42* | Initiate | *Goes to the group in front.*<br>How did you get 20min? *Lu, an articulate girl explains their reason for getting 20 minutes.* | |
| *43* | | | Its 5 to twelve so if we plus another 5 minutes that will be 12 past and we add another 15 minutes that will be 20 minutes<br><br>5 minutes x 4 which is 20 minutes |
| *44* | Affirm | + 5 | |
| *45* | Press | Why did you multiply by 4 | |
| *46* | | | because sir. Isn't it that we… |
| *47* | Elicit | (*interrupting)*Tell me. The train is supposed to be there at what time? | |

| | | | |
|---|---|---|---|
| *48* | | | At quarter past |
| *49* | Into correct English | At ¼ past? Was it supposed to be there at ¼ past or is it at ¼ past?<br>It arrives at ¼ past and what time was it supposed to arrive, at what time? | |
| *50* | | | At 5 to |
| *51* | Affirm<br>Elicit | At 5 to twelve so from 5 to twelve to ¼ past its how many minutes? | |
| *52* | | | 20 min |
| *53* | Evaluate | that's exactly what I was expecting | |

Bongani then pressed for more input from the learners and attempted to ensure that the group understood the English meaning of the question (turn 49). He was trying to emphasise the fact that the train actually arrived at ¼ past twelve yet his own choice of words " or is it at ¼ past" was itself unclear. Bongani later made good use of the "deconstruction" move and affirmed the learner who suggested the idea earlier, by drawing the clock on the board, and moving in groups of 5 minutes around the clock, from 5 to twelve till quarter past twelve. He provided a visual representation (written revoicing by repeating what a learner had done) on the blackboard, which clarified the learners' attempts at explaining the difference in minutes.

**Bongani resorts to funnelling**

The next excerpt follows on from the lesson mentioned earlier about horses and fowls. In this lesson the learners were struggling with the meaning of the question. Bongani did not pick up on this until well into the lesson which caused him to lose valuable time. By turn 193 Bongani resorted to funnelling by lowering the level of the question to a point where it was far below the level of the learners in a desperate attempt to get to the answer.

**Word problem*: 8 horses and a number of fowls have 40 legs together. How many fowls altogether?

| turn | Move | Teacher | Learner |
|---|---|---|---|
| *193* | Funnel | And 8 horses will obviously have how many legs altogether? If a horse has 4 legs then 8 horses will have? | |
| *194* | | | *Not answering at first……..*<br>32 |
| *195* | Affirm<br><br>Written | 32 legs. The 8 horses will have 32 legs altogether. 8x4 that's how we got the 32 *(writes 8 x 4 on the board)* Now what is left… *(inaudible)* now the 8 horses and the fowls have got 40 legs altogether. | |

| | | | |
|---|---|---|---|
| *196* | | | *6* |
| *197* | Evaluate<br>Elicit | 6?  6 what? Is that the remainder? What are we sure of? | |
| *198* | | | *8* |
| *199* | Affirm<br><br>Elicit | *(Again only following up on the correct answer)* 8 , 8 legs now we need to work out where do we get the 8 legs. If 8 horses have got 32 legs altog where do you get the 8 legs | |
| *200* | | | Fowls |
| *201* | Affirm<br>Funnel | Fowls. Ja, we need 8 legs from the fowls so how many fowls | |
| *202* | | | *4* |
| *203* | Access | We're gonna have 4 cause a fowl has 2 legs | |
| *204* | Written | We say 4 x 2 = 8  on the board | |
| *205* | Insert | So we know the number of horses is 8 and the number of fowls here is 4 | |
| *206* | Elicit | Are we happy with that one | |
| *207* | | | Yes |
| *208* | | Sure. Any questions | No |

In lesson 3, Bongani used funnelling extensively to get the learners to give the answer which he was expecting even though the questions were easy enough for them to answer as mental arithmetic e.g. 10 x 10 = 100 and 2 x 50c = R1. He first went through the long multiplication method of 10 x 10 which grade 6 learners already know. This was followed by lengthy back and forth about which side we begin when we multiply. After completing this procedure, the learners were then taught a short cut procedure.

This excerpt exemplifies a practice which Bongani used in all the lessons particularly clearly. In Appendix 5, further excerpts of funnelling in Bongani's lessons are provided.

**Can Bongani move the lesson along?**

Bongani indicated in his interview that his lessons took such a long time and that he was worried that he was getting behind schedule. I looked at this issue from a revoicing perspective to see if this strategy was contributing to the slow pace of his lessons.

In the excerpt below from lesson 1 we see how Bongani's questions influenced the pacing of the lesson.

In lesson 1 the first question given is as follows:

*<u>*Word problem*</u>: Mr Smith bought a motor car for 2 thousand 9 hundred and eighty rand and paid a quarter of the price in cash. How much did he still owe on the car?

A learner is at the board, subtracting R745 from R2980 using the vertical algorithm.

| Turn | Category | Teacher | Learner |
|---|---|---|---|
| 93 | | What do we do, we go (*Teacher leaves the room for a minute to ask the class next door to be less noisy. He returns to the class and says that the class next door are jealous of them and that's why they're making a racket.)*<br><br>*On the board is 2 9 8 0*<br><br>*- <u>7 4 5</u>* | *In meantime P is going through the algorithm competently doing the borrowing correctly.*<br><br>*He starts by crossing out the 8.....* |
| 94 | Deconstructing | Why are you borrowing from the 8?<br><br>Why not from the 9, why not from the 2? | |
| 95 | | | L: The 8 is here |
| 96 | Deconstructing | Why are we not borrowing from the 2?If I may check with the class, why are we not borrowing from the 2, from the 9 and we only decide we're gonna borrow from the 8? Why are we borrowing from the 8 specifically? | |
| 97 | | | Because the 8 is the nearest number |
| 98 | Press | Because 8 is the nearest number, is that the reason? | |
| 99 | | | Yes |
| 100 | Elicit | What is the reason here? Yes A. | |
| 101 | | | A: Because the 8 is in the 10's |
| 102 | access | Because.. | |
| 103 | | | the 8 is in the 10's |
| 104 | | M...? | |
| 105 | | | inaudible |

| | | | |
|---|---|---|---|
| 106 | Press | Because you cannot skip 8 and go to the digit before 8 to the 9 . Why?... | |
| 107 | Rephrasing by learner | | You cannot skip the 10's and go to the 100's |

It is significant that the excerpt began at turn 93 out of 142 turns on the same question. The following day Bongani went back to the very same problem and used turns 73 to 121 to tease out the solution further as he said "There was something I wasn't very much convinced yesterday. It seems like we rushed. You still have to convince me of the answer. *Reads out the question to the class. Mr Smith*….. I want you to tell me, if you are confronted with such a question, where do we start? What do you ask yourself after you've read the problem? What do you do? Where do you start?"

I detected a generous use of deconstruction as one of the ways in which he may be slowing the lessons down. I decided at a later stage that the deconstruction move appeared in the form of an automatic question such as "What is the reason here?" "Why did you do that?" or "How did you do that?" These questions were often given in response to a learner's display of established knowledge of how to subtract or multiply. If the learner had shown signs of struggling with the subtraction algorithm, it would have been appropriate for him to intervene. There were extremely few instances when a learner responded correctly to a question, showing that the required knowledge was in place, and it was not followed up with another question. This is not in itself a bad way to handle questions, but Bongani's questions did not help to move the lesson onwards and by his own admission were automative rather than purposive.

The excerpt below shows Bongani's difficulties in asking the right question at the right time.

**Word problem*: "What must be added to 105 to get 105?"

| Turn | Category | Teacher | Learner |
|---|---|---|---|
| *206* | | | Lu: so that we can get the remaining number which can be added from 105 to get 150 |
| *207* | Into maths language/ | *T:*So as to get the difference.<br><br>What makes the 2 amounts what number differentiates the 2 the number that makes 105 to be 105 and 150 to be 150. | |

| | | | |
|---|---|---|---|
| | | The number between? | |
| *208* | | | *45* |
| *209* | Press<br>Elicit | T 45. How sure are you that its 45?<br>T:so 105 + 45 gives you 150 and you are 100% sure.<br>...Do we need to multiply | |
| *210* | | | No |
| *211* | Elicit | Do we need to divide | |
| *212* | | | No |
| *213* | Evaluate | T: well done girls<br>*Goes to another group* | |
| *214* | Elicit | T:What is your answer | |
| *215* | | | Nk: 45 |
| *216* | Press | T: How do you know that your answer is 45? | |
| *217* | | | Nk:sir, because we subtracted 45 from 150 |
| *218* | Press | T: why did you subtract 45 from 150? | |
| *219* | | | Nk:to get the answer, the number that we add from 105... (*struggling to express himself*) |
| *220* | Insert + elicit | T: now if I were to add OK 60 to 105 would I be wrong? 60 added to 105 | |
| *221* | | | Nk: no sir it would be over 150 |
| *222* | Insert & elicit | T: over 150 so 150 whatever is added to 105 must give us 150 so if I added to 105 10,it gives me ? | |
| *223* | | | 115 |
| *224* | Affirm<br>press | T: its 115 ... so now how do we know that its 45? | |
| *225* | | | Nk:because we subtract 105 from 150 |
| *226* | Insert | T: so we don't divide so why are we subtracting | |
| *227* | | | Nk: because we want to get the answer, the number that we must add to 105 |
| *228* | Press | T: by subtracting 105 from 150. T: you're not convincing me yet. Why do we subtract. Basic operations Multiplic.... why did we choose | |

| | | | |
|---|---|---|---|
| | | subtraction. How does subtraction help you in this case? Can another group use addition to get the answer? | |
| *229* | | | Yes |

In turns 209 and 211 in the above excerpt, Bongani shifts away from the actual difference between the two numbers and what number should be added and focused instead on identifying the operations, a practice which was used throughout his lessons. In turn 220 above, the question also moved away from the central idea which is why we subtracted when the question asked us "what must we add" to a certain number to get to another number. The circularity of some of the teacher turns are emphasised by the fact that whilst a correct answer is offered immediately in turn 208, with a correct explanation of the meaning of missing addends in turn 206, the teacher turns right through to turn 228 re-insist on providing reasons for subtraction. This excerpt shows again that Bongani's use of the "deconstruct" move seems to work on what has already been established rather than supporting what is not yet established or is only partially established.

We observed above, an automatic type of questioning, which seemed to be for its own sake rather than to develop powerful understanding of the question. We know from Bongani's interview, that this is a well intentioned strategy, but often the purpose of the question was not clear. An example of this was in Lesson 3 (appendix 5) which started with Bongani asking learners to identify shapes. One of them was a circle which is the shape of a coin. This tenuous connection was used to introduce a lesson on addition and subtraction of coins. This showed a difficulty in making appropriate and logical links between different parts of the lesson. The result is that the focus of the lesson is shifted away from increasing mathematical understanding and more towards choosing of the correct operations. Careful rephrasing of questions and responses to learner answers might help to provide more meaningful closure.

**Refiloe**

Refiloe's lessons were tightly structured and moved, as she described, from the known to the unknown. She revised the required prior knowledge with her learners and then moved them on by posing carefully planned tasks.

Refiloe used short exchanges of IRF in all her lessons. She used the feedback category of "elicit" and "affirm" most of the time, eliciting what the learners knew and then letting them know immediately whether their answers were correct or not. She had tight control over the discussion and kept her learners engaged right through the lesson by moving at a fairly fast pace. Her use of the other feedback revoicing categories was considerably less. I have included the % moves table below to give the reader another picture of this. E.g. In the first column under R1 which stands for Refiloe's 1st lesson we see 9,8. This means that 9,8 % of her 254 moves for lesson 1 were to "initiate" .This went up to 24,3 % in the third lesson.

Refiloe: % teacher moves of total teacher moves

| IRE/F | | | **R1** | **R2** | **R3** |
|---|---|---|---|---|---|
| Initiate | | | 9,8 | 6,5 | **24,3** |
| Respond | | | | | |
| Evaluate | | | 4,3 | 0,27 | 1,9 |
| Feedback | | | | | |
| | Press | | 4,7 | 1,1 | 1,9 |
| | Elicit | | **22,4** | **31,2** | 13,1 |
| | Confirm | | / | / | / |
| | Insert | | 4,7 | 8,1 | 11,2 |
| | Maintain Revoice | REPEATING | | | |
| | | For access | 3,5 | 1,6 | 3,7 |
| | | To affirm | **29,5** | **31,9** | **24,3** |
| | | Written as is | 2,4 | 4,86 | 0,93 |
| | | REPHRASING | | | |
| | | Into correct English | 1,6 | 0 | / |
| | | Into maths language | 9,8 | 0,01 | 6,5 |
| | | Deconstruction | 4,3 | 0,01 | 1,9 |
| | | Funnelling | 2,8 | 0 | 10,3 |
| Total turns | | 1391 | 286 | 247 | 169 |
| teacher turns | | 746 | 152 | 128 | 88 |
| Total teacher moves | | 986 | 254 | 185 | 107 |

*Fig 15*

The move which Refiloe used the most was "elicit". In her first lesson, 22,4% (*see fig 15 above*) of the moves were used for "eliciting" information in order to revise 2D shapes and their properties before moving on to 3D shapes. In the model we see that 31,2% of her feedback moves in lesson 2 were used for "eliciting" some kind of answer from her learners.

She also used the revoicing move, "affirm", extensively. In lesson one, 29,5% of her moves were 'affirm' and in lesson two she used it for 31,9% of her moves. In lesson 3 the balance of the lesson changed with equal amounts of initiating and affirming.

In the following excerpt we see that 6 out of 20 turns are used for “affirm + elicit”. Unlike Bongani who rarely indicated to his learners until the end of a long section, if their answers were correct, Refiloe affirmed her learners throughout the lessons which contributed to the pace as she followed this with “elicit” in most cases.

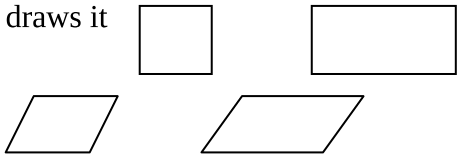
**Refiloe uses repeating**

| Turn | Move | Teacher/Refiloe | Learner(s) |
|---|---|---|---|
| 109 | Affirm<br><br>Initiate | T: a cylinder…. Let’s look at the shoebox. How many sides do I see? How many sides, how many faces (*emphasise the word faces*) …. Faces (pointing to the different faces on the box)<br>K..? | |
| 110 | | | K:6 |
| 111 | Affirm<br>Elicit | T: 6. And how many corners does it have… | |
| 112 | | | L: 8 |
| 113 | Affirm<br>Deconstruction | T: 8 yes. You have to literally count them. 8 corners and how many edges? You’d rather remove the lid if the lid is going to disturb you. | |
| 114 | | | L: it has got 12 |
| 115 | Affirm<br>Elicit | T: 12 what do we call corners in geometry. The corners of a geometric shape | |
| 116 | | | L: vertex |
| 117 | Affirm<br>Math language<br>Elicit | T: vertices. One is a vertex while more than one is vertices. Right lets look at the Toblerone. How many faces does it have? | |
| 118 | | | L; 5 |
| 119 | Affirm<br>Elicit | T: 5 faces how many edges does it have………… | |
| 120 | | | Lrs: some mutter 6 under their breath |
| 121 | Evaluate | T: its not 6 | |
| 122 | | | L: one says 10 then one says 9 |
| 123 | Affirm<br>Initiate | T: 9 its 9………Lets look at the rectangular prism (*she holds up a shoebox without the lid*) and lets identify the nature of the faces, the type of 2D faces that you can see. What do you see? | |

| | | | |
|---|---|---|---|
| 124 | | | L: a rectangle and a square |
| 125 | Affirm<br>Deconstructs<br><br><br>Funnel | T: OK you've got rectangles (*points to them*) and you've got squares (*points to them) The 'squares' are not strictly squares but the teacher lets it pass – not sure if she's noticed that*.<br>So how many squares are there? | |
| 126 | | | L: 2 |
| 127 | Affirm/ elicit | T: 2 squares and how many rectangles? | |
| `128 | | | L: 3….4 (*seems unsure*) |
| 129 | Deconstructs | T: OK count them. Count the rectangles that you see. | |
| 130 | | | Same L: 4 |
| 131 | Affirm<br>Elicit | T: 4 who can tell me why is it called a prism, prism p r i s m hey, not prison (*class laughs)* why is it called a prism. Give it a try guys, (*hands go up perhaps in response to the encouragement rather than pressure)* | |

Below is an example of how Refiloe used the move "affirm" as part of the revision section of her lesson. She combined this with written revoicing which assisted in keeping the ideas in the public domain and moving them forward.

| Turn | Move | Teacher/Refiloe | Learner(s) |
|---|---|---|---|
| 1 | Initiate | T: Take out your maths ex book. Write todays date. Do not write the topic again. Please underline the date. .......<br>Give me examples of 2 dimensional shapes. 2 d shapes. | |
| 2 | | | L: a rectangle |
| 3 | Affirm<br>Written | T: a rectangle (*T draws it on the whiteboard*) | |
| 4 | | | L:a triangle |
| 5 | Press | T: a triangle. Is it the only 2D shape that you can think of. | |
| 6 | | | L: Circle |
| 7 | | T: we'll come to that | |
| 8 | | | L:A rhombus (*T draws it*) |
| 9 | Affirm<br>Written | T: a rhombus | |
| 10 | | | L: (*inaudible)* |
| 11 | Affirm | T: a trapezium | |
| 12 | | | L: a parallela... |

| | | | |
|---|---|---|---|
| | | | (*Learner unable to complete the word*) |
| 13 | Written | T draws it  | |

In the next excerpt Refiloe used written revoicing again but this time the learners were more involved.

*<u>*Question*</u>: Find the number that is 4 less than the product of 18 times the sum of 16 and 23.

| Turn | Move | Teacher/Refiloe | Learner(s) |
|---|---|---|---|
| 170 | Elicit | Ah you're bringing your book! ... No I don't want the calculation, I want you to write the problem for us | |
| 171 | L:Written | | Girl starts writing the first part of the sum. (16 +23) |
| 172 | Confirm | Is the step right so far? | |
| 173 | | | Yes mam. *Another girl comes up to continue writing up the problem*<br>(16 +23) x 18 |
| 174 | Repeat for access | OK Find the number that is 4 less than the product of 18 times the sum of 16 and 23. So what is left out now? | |
| | L:Written | | *Girl writes* (16 +23) x 18 - 4 |
| 175 | L:Evaluate | | Boy: its correct |
| 176 | Affirm<br><br>Written | It's correct. Rewrites the sum bigger and clearer for learners to see. OK now where do I start. Z.. | |

Refiloe asked learners to write the question on the board which showed her how much they understood of the question. She provided the opportunity to see learners' appropriation of turning a word sum into symbolic notation. It also led to learners taking on the role of evaluating in turn 175. This could be seen as an instance of written rephrasing.

This form of written revoicing gave access to the learners to the mathematical process at hand. Although Refiloe discussed "inclusion" rather than "access" in her interview, she has used "access" in the above excerpt as well as the following excerpt in conjunction with affirmation. The ideas which she was revising were more than just the properties of shapes but the similarities and differences between the different shapes giving the learners access to "the learning potential of the situation" as well as "affirming".

| Turn | Move | Teacher/Refiloe | Learner(s) |
|---|---|---|---|
| 26 | Affirm<br>Press | T: 4 right angles. So what is common between the square and the rectangle? What is common? | |
| 27 | | | L: they both have right angles |
| 28 | Affirm/access<br>Press | T: both of them have got right angles.. but what makes them different from each other? I haven't heard a thing from this group. | |
| 29 | | | L: all sides are equal in a square and in a rectangle 2 opposite sides are equal |
| 30 | Affirm/Access<br><br><br>Initiate | T: all sides are equal in a square and in a rectangle 2 opposite sides are equal to each other.<br>Lets look at a rhombus. You said this is a rhombus and this is a parallelogram. OK. Properties of a rhombus. | |

**Refiloe uses rephrasing**

As mentioned above Refiloe used affirm and elicit the most but she also used other moves such as deconstruct in helpful ways at certain times. Below is an example of this from lesson 1.

| | | | |
|---|---|---|---|
| 111 | Affirm<br>Elicit | T: 6. And how many corners does it have… | |
| 112 | | | L: 8 |
| 113 | Affirm<br>Deconstructs | T: 8 yes. You have to literally count them. 8 corners and how many edges? You'd rather remove the lid if the lid is going to disturb you. | |

And another....

| | | | |
|---|---|---|---|
| 119 | deconstruct | *To another learner*. 67 so can you divide 67 by 55. If 67 children each have 55 sweets, how many sweets were divided among all the children? So what are you looking at? The total number of sweets that were there. | |

| | | | |
|---|---|---|---|
| | | So 67 children, right? Each child had 55 sweets. The question wants the total number of sweets before the sweets were divided amongst the children. So .... You multiply 67 x 55. | |

**Refiloe rephrases into mathematical language**

In lesson 2 Refiloe dealt with mathematical language in response to a learner's attempt to explain what a square root was.

| Turn | move | Teacher/Refiloe | Learner(s) |
|---|---|---|---|
| 9 | | | The square root is the ans.. the number that you have given what 2 numbers multiplied by itself equals the number..... |
| 10 | Into mathematical language | You find the number that when multiplied by itself will give you the number is the root. OK? So what's the square root of 121 | |

Another example of rephrasing into mathematical language from Refiloe's 3rd lesson, follows below.

The learners were going to fill in a puzzle by answering questions on division. Below is an excerpt which shows how Refiloe brought in mathematical language in another way. She was showing how questions which use division language require the learner to use multiplication to get to the answer. She pointed out to the learners that we use the "inverse" which she had explained in lesson 1. Refiloe knew the concept of "inverse" to be important in high school and so chose to emphasise it to her learners even though it was beyond the grade 6 curriculum.

| Turn | move | Teacher/Refiloe | Learner(s) |
|---|---|---|---|
| 16 | Initiate<br><br>funnel | *T goes through the questions very quickly.*<br><br>T: What is the dividend if the divisor is 92 and the quotient is 7? What are you supposed to do? We are given the dividend, we are given the quotient. What are we supposed to do? | |

| | | | |
|---|---|---|---|
| 17 | | | L: You must multiply 92 by 7 |
| 18 | Rephrase into mathematical language | T: So we use the inverse of division which is multiplication. We multiply 92 by 7. | |

The pattern of lesson 3 was quite different in that Refiloe initiated more than she elicited which is why her feedback in the "affirm" category, was lower than in the preceding lessons. I describe below how she also inserted and funnelled more during this lesson than the other lessons.

**Refiloe rephrases by funnelling**

Refiloe had taught these learners since grade 4 and was familiar with what they knew, particularly the language attached to the mathematics. In lesson 3 her learners easily talked about division in terms of divisor, dividend and quotient but they were not asked to make conjectures or justify their ideas at any stage. The teacher remained the judge of whether an answer was correct or not. Refiloe used the language of division to funnel the learners' answers as seen in this excerpt:

**Question:* . 994÷ placeholder = 14

| Turn | move | Teacher/Refiloe | Learner(s) |
|---|---|---|---|
| 35 | *(Math vocab)*<br><br>funnelling | T: 994 ÷ placeholder = 14 What are you going to do? You're supposed to divide because they've given you the dividend and the quotient. What are you looking for exactly? | |
| 36 | | | Lrs: the divisor |

I suggest that this was funnelling as the question was reduced to filling in the missing word out of three – dividend, divisor or quotient. By answering "the divisor" in turn 36, the learners were providing the missing word but research evidence and experience points out that this doesn't necessarily mean that they understood the function of the divisor.

Below is a similar example of funnelling suggesting that Refiloe was modelling a particular approach to solving these division sums instead of giving the learners some time to figure this out on their own using their own methods. In this instance, the learners were already familiar with the language of dividend, divisor and quotient and knew them to go together. If you have 2 of them you were automatically looking for the 3rd one which lowered the level of the task. The turns 67 and 71 were therefore coded as funnelling.

Another example of funnelling is given below.

*_Question:_ .   By which number must 222 be divided to give a quotient of 6

| Turn | move | Teacher/Refiloe | Learner(s) |
|---|---|---|---|
| 67 | funnel | T: By which number must 222 be divided to give a quotient of 6 so you've got the quotient and you've got the dividend. What are you looking for. | |
| 68 | | | L: divisor |
| 69 | Aff irm<br>Elicit | T: the divisor.<br>Should the divisor be smaller or bigger than the dividend? | |
| 70 | | | L: smaller |
| 71 | Funnel | T: smaller, .... so you will divide 222 by ...   (*funnelling?*) | |
| 72 | | | Lrs: 6 |

The focus on procedures and identifying operations can lead to learners lacking the conceptual knowledge to assess their own errors. This is evident in the following excerpt from lesson 3.  Despite the facility with the terminology of the division procedure, learners gave completely unreasonable answers to division sums.

| | | | |
|---|---|---|---|
| 114 | | | *Still busy with puzzle. One learner has the following written in his book*<br>153<br>—<br>5<br>15<br>Another learner has 67 divided by 5 = 130 with remainder 2 written and then crossed out. *(This indicates learners are struggling to understand what they're doing at a conceptual level)* |
| 115 | Initiate | What is the dividend if the divisor is 92 and the quotient is 7? T..? | |
| 116 | | | 654 |
| 117 | Affirm (doesn't deal with | 654.<br>Opens a learner's book and finds an error. Does 65 go into three  5 | |

| | | | |
|---|---|---|---|
| | misconception) | times? | |
| 118 | | | Learner squirms and tries to fix it |

In the concluding sections of this chapter, I summarise key aspects of the revoicing practice, and discuss the questions raised in relation to the categories that I used within my analysis.

## STAYING WITH AN IDEA OR MOVING THE LESSON ON

While revoicing is given credit in the literature for keeping an idea on the table for further exploration (O'Connor & Michaels, 1996; Brodie, 2010), it seems that it is not easy to achieve this in a way that builds understanding and moves the pedagogical agenda forward. My analysis indicates that Bongani tended to keep ideas on the table at length whilst Refiloe preferred to move on as soon as a correct answer was offered by a learner. She maintained a fast pace using repeating to affirm and then eliciting something in order to move the lesson forward.

### Bongani

Bongani had particular difficulty with this aspect as he automatically questioned every answer, often taking the learners backwards in the hope of checking and consolidating understanding. This was done at the expense of learners being able to move forward, using their current knowledge to learn more.

In lesson 2 he used 75 turns mostly by repeating the question and eliciting to get learners to see that the amount of time between 5 to 12 and quarter past 12 is 20 minutes. It points to the difficulty Bongani was experiencing in orchestrating a lesson which could move forward. He specifically mentioned this problem in his interview.

In the excerpt below, a learner gave the answer 2 235 rands in answer to Bongani's question "2 235 what?" Bongani then repeated his question saying that the answer was incomplete and expanded on the importance of labelling the answer. Nk.. gave the answer to the question and then Bongani repeated the answer and again reiterated the importance of putting in the label of "rands". During these 5 turns, the lesson had not moved forward to any extent and required a new turn to initiate or elicit information.

| Turn | move | Teacher/Bongani | Learner(s) |
|---|---|---|---|
| 6 | Elicit | T: 2 235 what? Is it goats, children...? The answer is incomplete. | |

| | | | |
|---|---|---|---|
| 7 | | | L: 2 235 rand |
| 8 | Insert (Elaborating on importance of completing the answer with a label) | The answer is incomplete. Please be careful when answering. I have said, if you are working on apples the answer should be on apples, if its pigs, the answer should be on pigs | |
| 9 | | | Nk..: Mr Smith still owes 2 thousand, two hundred and thirty five rands. |
| 10 | Affirm | 2 235 rands. That is very important, very very important. 2 235 is just a number OK? | |

**Refiloe**

In the excerpt below Refiloe read the question, made it easier by funnelling (a rephrasing move) the learners to the answer, dividend and then affirmed the answer dividend. By doing this the move came to a halt and required the teacher to make another move to take the lesson forward. This is a typical example of Refiloe's teaching style. We see again that the repeating category did not move the lesson forward.

| Turn | move | Teacher/Refiloe | Learner(s) |
|---|---|---|---|
| 55 | Elicit | T: so which operation are you going to do? | |
| 56 | | | Lrs: division |
| 57 | funnel | T: no 2 Placeholder ÷ by 3 = 155. We've got the quotient, we've got the divisor, what are we looking for? | |
| 58 | | | L: the dividend |
| 59 | Affirm<br>Elicit | T: the dividend.<br>How are you going to get the dividend/. This group, you're very quiet today. (*group near the door*) | |
| 60 | | | L: multiplication |
| 61 | Insert | T: WE have to multiply 155 by 3. | |

In the next excerpt we see that Refiloe was using rephrasing rather than repeating. This category was meant to move the lesson forward. However, in turn 101, Refiloe rephrased the learners answer in a similar manner as she would have affirmed the learner and had to follow up with a further question. If the questions are closed, as in turn 99, it makes it difficult to move the lesson forward by rephrasing.

| Turn | move | Teacher/Refiloe | Learner(s) |
|---|---|---|---|
| 99 | insert | What is the divisor? | |
| 100 | | | Mam, the divisor is the number that you divide by. |
| 101 | Math language | The number that you're going to divide.... so what are you going to divide? | |
| 102 | | | Inaudible |
| 103 | funnel | No! You've got 32 you've got 7. You're looking for this big number there. The dividend is the number that is being divided. So you're looking for the bigger number so which operation should we be using? | |
| 104 | | | Multiplication |

**Refiloe rephrases to move the lesson along**

In the following excerpt we have an example where rephrasing into mathematical language did help to move the lesson forward. In turn 139, Refiloe provided the learner with the language that she was lacking and the learner immediately used the new word to continue her statement. This is followed by writing the statement under discussion on the blackboard. This was a repeating move which gave access to the rest of the class to a particular mathematical idea.

| Turn | move | Teacher/Refiloe | Learner(s) |
|---|---|---|---|
| 136 | | | Karabo: 92 x 7 = 32 |
| 137 | | OK but I do not want you to change the concept. I want you to use the division concept. How would you right it? | |
| 138 | | | Mmm |
| 139 | Math language | Placeholder | |
| 140 | | | Placeholder divided by 92 equals to 7 |
| 141 | Written/access | Write it on the board | |
| 142 | | | Learner writes it as $\square \div 92 = 7$ |

From the work of both Bongani and Refiloe, it appears that rephrasing has more potential than repeating to move a lesson forward. However, neither revoicing moves can guarantee this movement. It depends on how the teacher makes use of the revoicing moves, how skilled they are at orchestrating discussion and the type of questions which are asked. An open style question such as the one below, can keep the idea on the table but also move the idea along at the same time by asking the learners to add to the idea.

What can the rest of you add to Phumzile's idea? *(asking the class to engage with the idea requires them to think about it)* (Forman & Ansell, 2002)

## CONCLUSION OF CHAPTER

My findings have led me to view the practice of revoicing as far more varied and complex than I initially anticipated. Each of the teachers had their own style of revoicing and used it for purposes which were sometimes similar and at other times quite different.

The ways in which revoicing is described in the literature, particularly as a way to orchestrate mathematical discussions was not a strong feature in either of these classrooms. It therefore made more sense to me to explore how revoicing could be deepened within the IRE/F structure (Brodie, 2010) as both teachers were using revoicing within this traditional lesson format.

Both teachers in my sample used revoicing in quite a limited way, unlike the more advanced ways of revoicing to position as suggested by O'Connor & Michaels (1996) or revoicing to keep the idea on the table for further exploration (Brodie 2008, 2010).

### Bongani

#### Repetition for access to English

Bongani was using revoicing mostly by repetition of the word problems.

He described his concern about his learners' lack of access to English other than in the classroom as a reason to revoice but this happened almost exclusively in the form of repetition of the question. When working on word problems he said that his learners needed to hear the question more than once. Unfortunately this 'keeping of the question in the public realm' (Brodie 2008, 2010), did not lead to the required level of understanding.

Bongani's response to questions about repetition was that he was committed to repeating the question often because his learners did not always understand the question. He stated that this was a very important strategy. He saw this as a way to give his learners access to the meaning of the question and said that he did it for the benefit of the learners, because they were ESL learners. Given this, it was surprising that he didn't try to rephrase the questions into everyday language as Refiloe did and made no attempt to encourage his learners to use their home language to try and understand the questions.

**Questioning**

The use of deconstruction tended to follow learners' demonstration of mathematical knowledge being in place rather than learner difficulties. This meant that the time spent on each word problem was very lengthy. After giving a correct answer to a question, the learner would be asked how s/he got that answer meaning "What procedure did you use?" or s/he would be asked why s/he had answered in that particular way. Bongani suggested that his questioning style might be inhibiting learners from broader participation. According to Lave & Wenger (1991), this lack of participation would result in limited appropriation of mathematical Discourse.

**Revoicing isn't always coherent**

Although revoicing, by repeating and rephrasing is hailed by Forman & Ansell (2002), O'Connors & Michaels (1996) and Moschkovich (1999), as a way for teachers to follow up coherently on what learners say, my findings show that this does not happen automatically. We can see from the excerpts in this chapter that feedback was not always coherent or helpful to the learners. Evidence of questions that disconnect from the previous turn or task within it, leading to lack of logical flow. It was not always clear to the learners where a question began and where it ended, resulting in an answer such as 7x7 is the square root of 49 or when asked why they were dividing R2980 by 4, learners said that they were trying to get an answer of 745.

The NCTM (1989) statement number 2 mentioned in chapter 2 suggests that orchestration involves "Deciding when to provide information, when to clarify an issue, when to model, when to lead, and when to let a student struggle with a difficulty".

Bongani's teaching style showed an interest in what his learners thought and a commitment to developing understanding but he was not making the necessary judgement calls referred to in the quote above. He responded to each of his learner's utterances with another question which did not link sufficiently to the previous learner utterance and was often asking the learner to explain what procedure had been used to arrive at an answer. Furthermore, his questioning style required the learners to give him the answer he had in mind and no other answer, which made it difficult for his learners to participate in the mathematical discourse promoted in both the NCTM (1989) and the NCS (2002) documents.

Anticipation of what might happen during a lesson and careful planning as to how to deal with such situations could help to make the lessons more time efficient. Knowing when learners have had sufficient support is not easy to judge and led to difficulties in orchestrating coherent discussion with his learners. The NCTM (1989) strand number 2 is also helpful here in reminding us “that teachers need to decide what to pursue in depth from among the ideas that students bring up during a discussion”.

**The most surprising finding**

The most surprising finding is the extent to which strategies for dealing with language were not in evidence in either classroom but particularly in Bongani’s classroom where most of his learners were not proficient in English.

Bongani, who cited language as a real challenge in his interview, did not seem to anticipate or respond to the challenge in order to assist his learners. Only 2,4% of his turns were dedicated to English in lesson 2 when the learners didn’t know what a fowl was. This could have been anticipated and cleared up at the start of the lesson but almost derailed the lesson instead. There were other times where Bongani’s own lack of fluency in English created communication difficulties. Although most of the learners were second language English speakers, and it was clear that English was a challenge in Bongani’s class, hardly any turns were used to facilitate the use of better understanding of English. There seemed to be an assumption that learners could function in English and home languages were not used at all as a resource (Moschkovich, 1999). Code switching (Setati & Adler, 2001) was also not used except when Bongani’s learners worked on their own in groups. Moschkovich (1999) would describe this as the learners using their home language as a resource. Bongani, however, neither encouraged nor discouraged this practice during the three days in which he was filmed which suggests that he did not consider the use of home language as a valuable resource.

**The need for coherence**

I have shown above how coherence isn’t necessarily an outcome of revoicing. We saw how often Bongani, due sometimes to his own difficulties with the LoLT, did not manage to bring coherence to the questions when learners struggled. Setati (2005) referred to above, pointed out how a teacher in her sample used English to teach procedures and when she really wanted learners to understand she defaulted into the home language of the learners which was seTswana in that particular class. This finding suggests that one requires a better command of a language to use it for the kind of feedback required for revoicing and rephrasing of learners everyday ideas. Bongani expressed frustration that there was no one home language that he could use to speak to his learners which is why he used only English. LPP, according to Lave & Wenger (1991) requires an apprentice to be attached to an expert. If our teachers are not yet fully competent themselves in the language of instruction or able to use questioning coherently, it makes the mentorship process extremely complex and uneven. However, this lack of coherence cannot be attributed to language constraints alone. Findings by Venkat & Naidoo (forthcoming) in South African primary schools displayed “poor coherence in and across pedagogic communication” even in schools where learners were being taught in their home language.

**Refiloe**

Refiloe tended to use revoicing in more varied ways although she used it extensively to affirm which is the closest move to evaluation and therefore situates her practice closer to the IRE component of the IRE/F structure. She also used revoicing successfully, in the form of rephrasing, in order to support her learners in moving their informal discourse towards more formal mathematical language. This finding supports the work of Setati & Adler (2001) although within an English only setting. Refiloe was not aware at first that she was revoicing but stated that she started from the unknown and moved to the known. She described how she used everyday informal language first and then rephrased it in more formal mathematical language. She used the example of corners and vertices to explain what she meant. She described another strategy in which she gets learners to rephrase from the more formal language to informal language in order to tell if the learners have understood what they had been learning. This strategy exemplified my second model described in chapter 2 in which revoicing can move between formal and informal in either direction.

Refiloe asked questions which required one word answers most of the time which she revoiced to affirm the learner. She then moved on immediately to elicit new information from her learners. She said that she used repetition for affirmation and stated that it was important to the learners to give the answers they thought the teacher wanted, hence the affirmation of their answers.

**Rephrasing to position**

When asked about rephrasing Refiloe referred to the idea of positioning learners although she only used it on the days that she was filmed. I quote: “I would rather say, OK alright, but who has an alternative answer to that and then link the two and try to find something that is (laughs) common or correct it but in a way that doesn’t shut the child down”. She was concerned not to shut the learner down if his/her answer wasn’t completely correct as she said used to happen with mathematics teachers when she was a child. Although she asserted that she gave ownership to learners for their ideas and suggested that she did use the debate style of teaching at times, the revoicing style which she used the most, “affirm and elicit”, was appropriate to the type of questions asked and the expected answers . It shows the relationship between the type of tasks given to learners, which were mostly closed questions, and the type of revoicing that was appropriate. A more open ended problem solving type of task as promoted in the NCTM (1989) and NCS (2008) documents might lend itself better to the type of revoicing to position which Refiloe referred to and both Enyedy (2008) and O'Connor & Michaels (1996) describe as an important function of revoicing. This finding also shows the importance of observation of teacher practices as there may be a difference between what Refiloe says she does in the classroom and what she actually does. I was not in her classroom for long enough to make such a judgement but given her awareness and clear explanation of the practice of mathematical debate, it is likely that Refiloe did use this practice more extensively than was observed and will use it in future. Refiloe's concern for her learners to be affirmed also led to funnelling learners to answers at times. I coded this as a type of rephrasing move although, as described by Bauersfeld (1980), not a productive move.

**Language issues**

Refiloe displayed a precision to her mathematical language, and her responses connected well to both the problem being discussed and what learners offered. In her interview Refiloe explained that her learners spoke a range of different home languages including English but that English was working well for her with most of her learners. Refiloe's treatment of her learners as if they were all English speaking, suited her style of teaching where she provided the language required by the learners. Occasionally a learner struggled to express him/herself and she rephrased their idea correctly, either into correct English or mathematical language. Were she to open up her lessons to a more exploratory style, it could place higher language demands on her learners and more appropriation of mathematical Discourse.

**Appropriation of mathematical terminology**

From analysing these lessons I can see that Refiloe's learners have already appropriated a good deal of mathematical language. They are already conversant with terms and concepts such as divisor, dividend, quotient, parallelogram, parallel, inverse etc.... This mathematical language is in the form of terminology rather than that of "doing mathematics" (Stein et al., 1996). She has been teaching them for 4 years and their level of competence with mathematical terminology suggests that multiple opportunities to appropriate mathematical language through rephrasing have been and continue to be provided.

### Room for the Discourse of "doing mathematics"

Brodie (2010) suggests that there is still room for learners to develop the Discourse of conjecturing, explaining and justifying within a traditional IRF lesson. The key ingredient to a successful IRF lesson is the type of feedback which is provided and the way in which the discussion is orchestrated. Feedback can open up ideas by using purposive revoicing moves or it can close off an idea through continual use of closed questioning, evaluation and affirmation as it requires another question or feedback move to continue the lesson. I have shown this to be typical of Refiloe's lessons. Although there seemed to be a high level of success in terms of "getting answers right" and using the correct terminology in Refiloe's class, her learners were not being asked to make conjectures and justify them. Stein et al., (1996) might say that they weren't really "doing mathematics".

A broader repertoire of questions including questions like those raised in chapter 2 by Forman & Ansell (2002), might be helpful to transform a lesson from a focus on operations and procedures to a more exploratory focus on the concepts and connections underlying the procedures. This in turn will assist learners in appropriating the required mathematical Discourse by participating in the Discourse through their discussions. Only then will learners have true access to "the learning potential of a situation" as described by Lave & Wenger (1991 p.43).

# CHAPTER 5: CONCLUSION

## INTRODUCTION

This study has focused on two teachers' use of revoicing feedback moves to support their learners' attempts to communicate mathematically. As noted in my literature review, this practice has been highlighted in the literature as a useful way to orchestrate whole class discussions. It has been promoted as particularly helpful amongst learners who are 2nd language English speakers in environments where English is the language of instruction. This is so because revoicing moves can help learners to interact between different languages as well as between informal and formal language.

In introducing the context of my study in chapter 1, I explained the effect of historical and political factors on the choices made by the South African Government, parents, teachers and how these sometimes run contrary to recommendations made by international research. I explained these choices later in the study by referring to Gee's (1996) notion of cultural models. In chapter 2 I show how revoicing, a concept borrowed from linguistics, is located within the current emphasis on communication in mathematics classrooms. The promotion of Strand 2 in the Principles and Standards document produced by the NCTM in 1989, resulted in numerous research projects in the US and elsewhere exploring different types of communication. In South Africa, Setati, Adler and Brodie have looked at various aspects of communication which lay the foundation for my study. Setati and Adler's (2001) work on multilingual issues together with their model of the various paths which learners can take to move from informal, oral mathematical discourse in their home language to formal written mathematical discourse in English, as required by the current schooling system raise several challenges for South African teachers. Revoicing has been suggested as a practice which teachers can use to enable learners to traverse those paths. I have used the theoretical framework of Legitimate Peripheral Participation (Lave & Wenger, 1991) to understand the learner in an apprenticeship role as they learn to participate in mathematical communication. The expert in this case, is the teacher whose role it is to support their learners' appropriation of mathematical communication using revoicing moves. I have not focused on the actual appropriation of learners' mathematical Discourse as this would be more suited to a longterm study. I have instead examined the attempts by the teachers to make this possible. In chapter 3, I explain how I planned and executed my research. I used a qualitative design, observation using videotaping of lessons as well as interviews with the two teachers using audiotaping. My coding model draws on the broad categories of feedback suggested by Brodie (2008, 2010) and Forman & Ansell (2002). In the end I included more detailed revoicing categories that were particular to the teachers in my sample. A coding model was drawn up so that I could see exactly how often the various types of feedback moves were used. This also revealed which moves were least used.

Chapter 4 begins with an introduction to both the teachers through their interviews. It gives their views about teaching and their own understanding about their practices, whether revoicing or not. I then show the detailed coding model which is explained as well as the inclusion of relevant excerpts which are used to show examples of practices which are of particular interest. In this chapter, I use my analysis to discuss the openings for learner appropriation of mathematical discourse.

Below I restate my research question and comment on the conclusions I have reached through doing this study.

**RESEARCH QUESTION**

> What is the nature and range of revoicing strategies used by the teachers in the sample in an effort to open up opportunities for learners to participate in mathematical discourse?

**KEY ARGUMENTS IN THE LITERATURE**

In the literature I have studied, revoicing has been identified as a practice to be encouraged. It is said to be a key practice used by teachers in the orchestration of whole class discussions (Forman & Ansell, 2002). The reasons given for this are that the revoicing practice has the potential to keep learners' ideas in the public realm while giving other learners an opportunity to think about and interact with them (Brodie, 2008). It also plays a role in giving learners ownership of their own ideas as the skilled teacher can position learners' ideas in relation to each other and in relation to the discipline of mathematics (O'Connor & Michaels 1993, 1996). Moschkovich (1999) as well as Setati & Adler (2001) suggest that revoicing is a key practice to use in multilingual classrooms as learners informal ideas can be voiced in their home language and then revoiced by the teacher or other students into English and/or a more formal mathematical way of talking. As mentioned in chapter 2, Enyedy et al., suggested that teachers' beliefs about teaching as well as the richness and extent of their "pedagogical toolkit" (p.157) determine whether they use revoicing to foster debate or in less advanced forms such as repetition and rephrasing. This points to possible constraints which might prevent some teachers from using revoicing to achieve the aims mentioned above. I found this caveat by Enyedy pertinent to my study as the teachers in my sample have different challenges to deal with and have had different learning and teaching experiences themselves.

## KEY FINDINGS AND ANALYSIS

Both teachers in my sample used revoicing, but in quite a limited way, unlike the more advanced ways suggested by O'Connor & Michaels (1996) where the emphasis was to keep the idea on the table for further exploration. However, as mentioned in chapter 3, only two out of the seven teachers who were initially observed were using revoicing as part of their practice. This suggests that the two teachers in my study are further along than other teachers, in terms of their revoicing feedback practices within the IRE/F structure.

Bongani, who was very concerned about his learners' lack of access to English other than in the classroom, used revoicing mostly in the form of repetition of the question. He was working on word problems and said that his learners needed to hear the question more than once. By doing this, Bongani was keeping the question in the public realm as recommended by Brodie (2008) but it often did not lead to the required level of understanding. Rephrasing of questions instead of repeating of questions might lead to better understanding of questions. Use of Setati & Adler's (2001) suggested pathways can support learners in moving from their own informal understanding in home language towards the required Discourse. Another move which Bongani used extensively was to deconstruct most of his learners' answers by asking questions (coded often as press) about how the learner arrived at an answer and why in that way. Deconstruction can be a helpful move when learners are struggling with a complex concept. However, the tension between the benefits of deconstruction and the need to move a lesson along were evident in Bongani's lessons. Sfard's (1991) notion of reification says that maths proceeds by reifying some processes into objects and then building forwards. The unravelling of every answer implies that no mathematical knowledge was in place (reified), which contributed to a slow and inefficient pace in the lessons. As an example, the multiplication of 10 times 10 using the long multiplication algorithm (see appendix 6) as well as a short method, was unnecessary as the learners had already shown their knowledge of 10 multiplied by 10 being equal to 100 as a reified mathematical object. Bongani said that his learners knew that if they answered a question, that would not be the end of it. They would be asked how they got that answer which inevitably meant 'What procedure did you use?' or he would ask why they answered in that particular way. He also noted that this might be the reason why only a few of his learners offered to participate.

Bongani's response to questions about repetition was that he was committed to repeating the question often because his learners did not always understand the question. He stated that this was a very important strategy. He saw this as a way to give his learners access to the meaning of the question and said that he did it for the benefit of the learners, especially because they are ESL learners. Given this, it was surprising that he didn't try to rephrase the questions into everyday language as Refiloe did and made no attempt to encourage his learners to use their home language to try and understand the questions. Within the theoretical framework of LPP (Lave & Wenger, 1991) Bongani's learners were given singular access to mathematical Discourse through extensive use of repeating. On the other hand, Refiloe's use of more rephrasing moves gave her learners broader access to the mathematical Discourse required. In my study, the apprenticeship role of the learners in appropriating mathematical Discourse was only observed on occasion. An example of this was when Refiloe rephrased a term used by a learner and the rephrased term was used later in the discussion by that same learner.

However, Refiloe often asked questions which required one word answers which she revoiced to affirm the learner. She then moved on immediately to elicit new information from her learners. Refiloe was not aware at first that she was revoicing but stated that she starts from the unknown and moves to the known. She described how she used everyday informal language first and then rephrased it in more formal mathematical language. She used the example of corners and vertices to explain what she meant. This explanation of Refiloe's links directly to both Pimm's (1991) and Setati & Adler's (2001) descriptions of the various paths which teachers and learners make use of to develop mathematical discourse. Refiloe described another strategy in which she gets learners to rephrase in the reverse direction, from the more formal language to informal, everyday language in order to tell if the learners have understood what they had been learning. This strategy exemplified my second model described in chapter 2 in which revoicing can move between formal and informal in either direction.

Refiloe said that she used repetition for affirmation and stated that it was important to the learners to give the answers they thought the teacher wanted, hence the affirmation of their answers.

When asked about rephrasing, Refiloe referred to the idea of positioning learners. This practice is regarded by O'Connor & Michaels (1996) as a key revoicing practice and was used by Refiloe on the first day that she was filmed. She was concerned not to shut the learners down if their answer wasn't completely correct as she said used to happen with mathematics teachers when she was a child. Although she asserted that she gives ownership to learners for their ideas and suggested that she does use the debate style of teaching at times, the revoicing style which she used the most was "affirm" followed immediately by "elicit". I have suggested that this style of revoicing suited the closed type of questioning which sometimes even led to funnelling. A more open style of questioning requiring learners to make conjectures and justify their thinking, might lead to a revoicing style closer to that suggested by the literature. The more open ended problem solving type of task as promoted in the NCTM (1989) and NCS (2002) documents might lend itself better to regular use of the type of revoicing to position which Refiloe referred to and both Enyedy et al., (2008) and

O'Connor & Michaels (1996) describe as an important function of revoicing. As already mentioned this finding also shows the importance of observation of teacher practices as there may be a difference between what Refiloe says she does in the classroom and what she actually does. I was not in her classroom for long enough to make such a judgement. Refiloe also funnelled learners to answers at times which I described as a type of rephrasing move although, as described by Bauersfeld (1980), not a productive move.

## HOW FINDINGS CONTRIBUTE

### Confirm

The limited ways in which the two teachers used revoicing confirm the idea that revoicing is not yet widely used in classrooms. It also confirms the suggestion by Enyedy et al., (2008), that the extent and type of revoicing which is used by teachers is dependent on their beliefs and the level of development of their own "pedagogical toolkit". Bongani often requested assistance in this regard.

### Extend

My findings also extend the work of Forman & Ansell (2002) as well as Brodie (2008, 2010) in that I have found a range of different ways in which revoicing is used by teachers. Forman & Ansell (2002) describe revoicing as repeating and rephrasing as well as summarising, translating and elaborating. My categories emerging from my sample fell more within repeating and rephrasing which I used as broad overarching categories. I then included subsets of these two categories which are related to the purpose of the repeating or rephrasing move i.e. repeating to give learners access to the meaning of the English of the word problem, rephrasing into mathematical language (exposing learners to mathematical Discourse), funnelling which is a form of rephrasing focussed on getting to the answer etc.... Brodie (ibid) referred to "maintain" as a revoicing move because it keeps an idea in the public realm. She situated this within the IRE/F model as a feedback move used by teachers. Although orchestration of whole class discussions was introduced as an alternative to the IRE style teaching, I have taken Brodie's (ibid) idea forward, treating revoicing with all its subcategories as a feedback move which can be used to orchestrate whole class discussions.

### Challenge

While I agree that revoicing has enormous potential to move our pedagogical agenda forward, helping learners to express their mathematical ideas and argue for and against other learners' ideas, I have seen that this is not an easy process. Revoicing does not automatically do all these things. It has the potential but requires a certain level of skill on the part of the teacher to orchestrate a range of learners' ideas. As an example, Bongani's use of revoicing was limited to extensive repeating of the question and his own difficulties with language pushed him into taking a calculational route (Setati, 2005). There were difficulties in communication in his class with several misunderstandings and disconnects between ideas, causing the import of learner offerings to be lost and therefore not taken up. This points to the difficulty in orchestrating a whole-class discussion (in front of a camera) which maintains mathematical coherence. This new skill of improvisation requires an ever increasing pedagogical toolkit.

Although not included in the coding instrument for this study, instances of using the chalkboard for rephrasing did occur on occasion in Refiloe's lessons. She suggested that positioning learners in a debate style discussion is something which she already does. Although I only witnessed it on the first day, she demonstrated a clear sense of how this is done which shows great potential for this type of practice to be used effectively in her class. Her choice of tasks tended to limit the discussion to right or wrong answers rather than broader conjecturing and justifying of their own answers by learners. This points to a possible difficulty in trying to use revoicing in the more traditional IRE/F setting.

## THE WAY FORWARD

This study cannot be generalised to a broader population but it does reveal possible patterns that we might find amongst other teachers. As explained in my sampling, there is also the possibility that the practices of these two teachers are somewhat stronger than those in use more broadly. There are two main ways in which I can see a way forward with this line of research.

Firstly, it would be helpful to investigate the following issues:

1. How widespread the use of revoicing is at present, given the numerous constraints within which teachers manage to teach
2. What types of revoicing are used the most or least. This investigation could make use of the coding model developed for this study and include space for other types of revoicing categories which might emerge.
3. To what extent is the multilingual nature of classrooms treated as a resource or a hindrance.

A second line of research is to work with a group of teachers as a Professional Learning Community in order to help increase their repertoire of revoicing feedback moves and to assess what effect this might have on their teaching practices and their learners' resultant appropriation of mathematical Discourse. This line of research follows on from the work done by Brodie (2008, 2010) and will help to extend and broaden the pedagogical toolkits of South African teachers.

APPENDIX 1: INFORMATION LETTER AND INFORMED CONSENT SIGN-OFF SLIP - TEACHER

Dear ……………………………….,

I am currently involved in a research study as a requirement for a Masters degree at the University of Witwatersrand. My research study is focused on mathematical communication between teachers and learners and between learners and learners. In order to do this, I need to understand the nature and range of teachers' current classroom practices. Video and audio records allow the capturing and tracking of the development of communication.

I would like to sit in on your class near the beginning of the third term(July/August 2011) for the duration of a week to observe a series of lessons on a topic such as division. I would also like to conduct one informal interview with you focused on understanding your reasons for your classroom actions.

I am writing here to formally ask for your written consent to collect the following data in your classroom

-videos of classroom observation

-audiotape of learner discussions

- informal teacher interview

- possible interviews of a few learners

I wish to assure you that any information that you relate during informal interviews, and in observations will remain anonymous. I undertake to maintain anonymity by using pseudonyms of all participants and the school in my reporting of this work. The videos will not be made available more widely without separate permissions being sought. Within 5 years, the videos will be destroyed.

I trust that you will accept this invitation to participate in the project. You are of course, free to withdraw permission for data to be collected or used for research at any stage along the way.

We very much hope that this research project will ultimately have benefits for you and the learners in your classroom. Please do not hesitate to contact me (011 717 3257 or 084 485 6704) if you require further detail or clarification.

Best wishes,

Jessica Sherman

Division of Mathematics Education

Wits School of Education

Jessica.Sherman@wits.ac.za

I **give / do not give** permission for data (non video-based) collected within ____________________________

(name of school) to be used for research purposes.

I **consent / do not consent** for teacher and learner video data collected within _________________________

(name of school) to be used for research purposes.

Teacher name: _____________________________________

Teacher signature: __________________________________

Date: ____________________________________

APPENDIX 2: INFORMATION LETTER AND INFORMED CONSENT SIGN-OFF SLIP - LEARNER

Dear learner,

I am currently studying for a Master's degree at the University of Witwatersrand and am required to submit a short research study in the field of mathematics teaching and learning.

I am writing here to request your written consent to collect the following data in your classroom.

-videos of classroom observation

-audiotape of learner discussions

-possible interview of a sample of learners

My research study is focused on mathematical communication in your lessons. In order to do this, I need to understand the nature and range of classroom interactions. I would like to use video and audio records to capture interactions.

I would like to sit in on your primary school class near the beginning of the third term(July/August 2011), for the duration of a week, to observe a series of lessons.

I undertake to maintain anonymity of yourself and the school in my reporting of this work. The videos will not be made available more widely without separate permissions being sought. Within five years the video tapes will be destroyed.

I hope that you will accept this invitation to participate in the study. You are of course, free to withdraw permission for data to be collected or used for research at any stage along the way.

We very much hope that this research project will ultimately have benefits for you and your teacher. Please do not hesitate to contact me (011 717 3257 or 084 485 6704) if you require further detail or clarification.

Best wishes,

Jessica Sherman

Division of Mathematics Education

Wits School of Education

Jessica.Sherman@wits.ac.za

I **give / do not give** permission for data (non video-based) collected within ______________________________

(name of school) to be used for research purposes.

I **consent / do not consent** for teacher and learner video data collected within ___________________________

(name of school) to be used for research purposes.

Learner name: ________________________________________

Learner signature: ____________________________________

Date: _______________________________________

APPENDIX 3: INFORMATION LETTER AND INFORMED CONSENT SIGN-OFF SLIP - PARENT / GUARDIAN.

Dear Parent/guardian,

I am currently studying for a master's degree at the University of Witwatersrand and am required to submit a short research study in the field of mathematics teaching and learning.

I am writing here to formally ask for your written consent to collect the following data in your child's classroom.

-videos of classroom observation

-audiotape of learner discussions

-possible interview of a few learners

My research study is focused on mathematical communication between teachers and learners and between learners and learners. In order to do this, I need to understand the nature and range of teachers' current classroom practices. Video and audio records allow the capturing and tracking of communicational development.

I would like to sit in on an primary school class near the beginning of the third term(July/August 2011), for the duration of a week, to observe a series of lessons on a topic such as division.

I undertake to maintain complete anonymity of your child and the school in my reporting of this work. The videos will not be made available more widely without separate permissions being sought. Within five years the video tapes will be destroyed.

I trust that you will accept this invitation for your child to participate in the study. You are of course, free to withdraw permission for data to be collected or used for research at any stage along the way.

We very much hope that this research project will ultimately have benefits for the teacher and your child. Please do not hesitate to contact me (011 717 3257 or 084 485 6704) if you require further detail or clarification.

Best wishes,

Jessica Sherman

Division of Mathematics Education

Wits School of Education

Jessica.Sherman@wits.ac.za

I **give / do not give** permission for data (non video-based) collected within ______________________________

(name of school) to be used for research purposes.

I **consent / do not consent** for teacher and learner video data collected within ___________________________

(name of school) to be used for research purposes.

Parent/guardian name: ________________________________________

Parent/guardian signature: _____________________________________

Date: _______________________________________

APPENDIX 4: INFORMATION LETTER AND INFORMED CONSENT SIGN-OFF SLIP - PRINCIPAL

Dear Principal,

I am currently studying for a master's degree at the University of Witwatersrand and am required to submit a short research study in the field of mathematics teaching and learning.

I am writing here to formally ask for your written consent to collect the following data in your school .

-videos of classroom observation

-audiotape of learner discussions

- informal teacher interview

- possible interviews of a few learners

My research study is focused on mathematical communication between teachers and learners and between learners and learners. In order to do this, I need to understand the nature and range of teachers' current classroom practices. Video and audio records allow the capturing and tracking of communicational development.

I would like to sit in on a primary school (preferably grade 5) class for the duration of a week near the beginning of the third term (July/August 2011), to observe a series of lessons on a topic such as division.

I undertake to maintain complete anonymity by using pseudonyms of all participants and the school in my reporting of this work. The videos will not be made available more widely without separate permissions being sought. Within five years these videos will be destroyed.

Thank you for accepting the invitation to participate in this project at this stage. You are of course, free to withdraw permission for data to be collected or used for research at any stage along the way.

We very much hope that this research project will ultimately have benefits for the teacher and learners in your school. Please do not hesitate to contact me (011 717 3257 or 084 485 6704) if you require further detail or clarification.

Best wishes,

Jessica Sherman

Division of Mathematics Education

Wits School of Education

Jessica.Sherman@wits.ac.za

I **give / do not give** permission for data (non video-based) collected within ______________________________

(name of school) to be used for research purposes.

I **consent / do not consent** for teacher and learner video/audio data collected within ___________________________

(name of school) to be used for research purposes.

Principal name: ________________________________________

Principal signature: ____________________________________

Date: _______________________________________

**APPENDIX 5 : LESSON 3 BONGANI**

| turn | move | Teacher | Learner/s |
|---|---|---|---|
| 1 | Initiate | T:Alright boys lets start. Pg? The answer's correct | *Only boys. The girls are at a talk and will join them later.* |
| 2 | Initiate | T:What shape has a R1 coin? Do you all know what a R1 coin is? | |
| 3 | | | Chorus: yes (boy holds up a coin) |
| 4 | Elicit | T: what is that shape? (*Hands go up*).<br><br>T: do you know shapes ? come give me examples of shapes. Yes my boy? Come again. | |
| 5 | | | L: triangle |
| 6 | Affirm/Elicit | T: how many sides does a triangle have | |
| 7 | | | 3 |
| 8 | Affirm/Elicit | 3 T: and if its got 3 sides it means its gonna have how many angles. How many angles? | |
| 9 | | | 3 |
| 10 | Evaluate<br><br>Elicit | T: 3 very good. So we know what shapes are – any other examples of shapes | |
| 11 | | | L: hexagon |
| 12 | Affirm<br><br>Elicit | T: hexagon hexagon how many sides does a hexagon have? P... | |
| 13 | | | 6 |
| 14 | Affirm<br><br>Elicit | T: 6 yes my boy. The one with 7 sides, what do we call it? | |
| 15 | | | L: hectagon |
| 16 | Elicit | T: is it hecta hectagon? | |

| | | | |
|---|---|---|---|
| | Maths language | | |
| 17 | | | L: heptagon |
| 18 | Initiate | T: what shape does a R1 coin have | |
| 19 | | | L: circle |
| 20 | Affirm<br><br>Initiate | T: its a circle. No 2 you can read out for us. Yes P... | |
| 21 | | | P: reads quietly |
| 22 | Access | T:What number multiplied by itself equals 49? | (*hands go up enthusiastically)* |
| 23 | | | L: 7 x 7 = 49 |
| 24 | Elicit | T: so the answer will be? | |
| 25 | | | Lrs: 7 x 7 =.... |
| 26 | Access | T:what number multiplied by itself is equal to 49 | |
| 27 | | | L: 7x7 = 49 |
| 28 | Insert/ elicit | T:reads the question again. I'm looking for 1 number 1,1 ,1 number multiplied by itself 1 multiplied by itself. | |
| 29 | | | L: its 7 |
| 30 | affirm<br><br>insert | T: Its 7, not 7 multiplied by 7. Yes its 7 multiplied by 7 but we're looking for a number or a digit multiplied by itself. Its 7 multiplied by itself and will give us 49 so the answer is 7. So boys don't be confused here its correct for you to say 7 multiplied by 7 is 49 but listen to the question – its what number....(*reads the question again).*<br><br>Its gonna be 7. How many of you got that right, just 7. | |
| 31 | Initiate | OK.Lets go to c) read it out for us | |
| 32 | | | Joan has 2 50c pieces, 5 20c pieces and 10 10c pieces in her money box. |

| | | | |
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| | Elicit | How much is that? Hands up. | How much money has she? |
| 33 | | | L: It's R3 |
| 34 | Affirm<br><br>press | T: How did you get 3 rand? It's 3 rand, I agree but how did you work it out. How did you work out the answer. (*Reads the question again*)<br><br>How did you get the 3 rand how did you work out the answer? Asks over and over again. | |
| 35 | | | L: answers but inaudible |
| 36 | Affirm<br><br>funnel | T: you added OK there's 2 50c pieces and how many 20c pieces | |
| 37 | | | 5 |
| 38 | Affirm<br><br>funnel | T: there's 5 and how many 10c pieces | |
| 39 | | | 10 |
| 40 | Evaluate<br><br>elicit | T: very good now which operation do you use here. Did you multiply, did you divide, added, subtracted ? | |
| 41 | | | L: addition |
| 42 | Affirm<br><br>Elicit | T: you used addition so you added.... and any other operation | |
| 43 | | | L: multiplied |
| 43 | Affirm<br><br>funnel | T: multiplied (*shows its the answer he's looking for*). Lets look at multiplication (*goes to the board*) how many 50c pieces | |
| 45 | | | 2 |
| 46 | funnel | T:2 fifty cent pieces. So if you're going to multiply you're going to multiply what. 50c by what. | |
| 47 | | | L: mumble |

| | | | |
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| 48 | Affirm<br><br>funnel | T: 50c multiplied by 2 cause there's how many | |
| 49 | | | Chorus with the teacher: 2 50c pieces |
| 50 | Written<br><br><br>Funnel | T: draws the sum on the board in vertical form. 50<br>x <u> 2</u><br><br>2 multiplied by 0 is what, Marshall | |
| 51 | | | 0 |
| 52 | Affirm<br><br>funnel | T: 0 anything multiplied by 0 is 0. And 2 multiplied by 5 ..... yes my big boy.. | |
| 53 | | | L: 10 |
| 54 | Affirm<br><br>elicit | T: 10 (*ends with 100 on the board*) 100 what | |
| 55 | | | Lrs: cents |
| 56 | Affirm<br><br>funnel | T: and 100 cents converted to rands how much is that | |
| 57 | | | L: R1 |
| 58 | Affirm<br><br>elicit | T: R1 now I want you to work out the $2^{nd}$ one the 5 20c pieces. | |
| 59 | written | | (Boy goes to the board and writes up the sum and does it correctly)<br><br>20<br><br><u>X 5</u><br><br><u>100</u> |
| 60 | Affirm<br><br>elicit<br><br>Evaluate | T: 100 what? (learner puts in the c for cents) and what is 100c (learner writes = R1) excellent. | |
| 61 | elicit | T: The last one. Yes | |

| | | | |
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| 62 | written | | N... (goes to the board)<br><br>N... writes with confidence 10c<br><br>x 10<br>100c |
| 63 | *Evaluate actively lowering the level by insisting on the use of the algorithm even though learners know the answer* | T: .mmmm short cut? Do it again, lets see. Apply your mind, don't be fast, do the right thing. (N... thinks he's answered incorrectly). He redoes the sum on the board but gets confused after putting down 00. (*hands go up and N... ponders and gets stuck*)<br><br>T: M... help him | |
| 64 | | | (*N... goes to sit down*) |
| 65 | Social norms | No stay there. M... tuck in your shirt. Help him. Single handed. One handed. Let me help you (*T tucks in M...'s shirt with one hand).*<br><br>Like a school boy not like a thug. | |
| 66 | | | *( M... wipes off the zeroes after T says he can't see what is going on. He writes 1000 as the answer.*) |
| 67 | | Lets see | *Hands go up* |
| 68 | | P... quickly. | *(P... comes up and does the standard long multiplication approach.)* |
| 69 | Evaluate<br><br>Written<br><br><br>Initiate | T: Perfect. Now lets do it together. It's 10 multiplied by 10, 10c multiplied by 10, OK. M.., N..., Where do we start when we multiply? Where do we start? We start from the RHS or from the LHS? Yes, Mk...? | |
| 70 | | | Mk: mumbles something |
| 71 | Funnel | T: We start from the | |

| | | | |
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| 72 | | | Mk: inaudible again |
| 73 | Funnel | T: We start to the RHS?.... | |
| 74 | | | Mk...: ah the LHS |
| 75 | Funnel | T: We start from the LHS and work to the RHS? Yes G...? | |
| 76 | | | G: We start to the RHS |
| 77 | Funnel | T: do we start to the or from?. Come on.. We start from... | |
| 78 | | | G: the LHS |
| 79 | Funnel | T. to... | |
| 80 | | | G: the RHS |
| 81 | affirm | T : We start from the RHS | |
| 82 | Evaluate | T: to the LHS. Very good | *(G... gesturing and speaking)* |
| 83 | Written<br><br>Insert<br><br>deconstruct | Goes to the boards and writes up<br>10c<br>x 10<br><br>T: *pointing to the board*. Its 0 multiplied by that 0 there. So our zero is going to be where (*pointing to the 0s vertically)* – so its going to be underneath this one. Do you understand that? | |
| 84 | | | Chorus: yes |
| 85 | Elicit access<br><br>funnel | T: and zero multiplied by 1 . What is zero multiplied by 1? What is zero multiplied by 1? (*inaudible talking to a student in low tone*).It's? | |
| 86 | | | L: zero |
| 87 | Affirm & elicit | T: its zero. Anything multiplied by zero its ?.. | |
| 88 | | | Chorus: zero |

| | | | |
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| 89 | Elicit | T: 1 multiplied by zero its | |
| 90 | | | Chorus: zero |
| 91 | Elicit | T:million multiplied by zero its | |
| 92 | | | Chorus: zero |
| 93 | Elicit | T: 1 multiplied by zero its | |
| 94 | | | Chorus: zero |
| 95 | Insert<br>Deconstruct/funnel | T: look where that zero is cause we're multiplying that one(*points to the 1 in the 10's column*) by zero its going to be there.<br>And now we come to.. We multiply our ten cents by zero, by the units, OK? Now we come to the ... | |
| 96 | | T: tens | Chorus: tens |
| 97 | Elicit<br>Deconstruct/funnel | T: this one ... now look at this. It's 1 multiplied by . | |
| 98 | | T: zero | Chorus: zero |
| 99 | Insert & elicit<br>Deconstruct/funnel | T: and remember it is on the ten the place value there is what? Its 10 cause on the 10 it is 10 not even1. But its fine, let us not confuse one another . 1 multiplied by 0 is | |
| 100 | | | Chorus: zero |
| 101 | Insert<br>deconstruct | T: and look at me , look at where my zero is gonna go. Its gonna come down here (*writes in the 10s column under the zero)*cause now we are multiplying by this one OK | |
| 102 | | | Chorus:Yes |
| 103 | Deconstruct/<br>Funnelling | T: and we say 1 multiplied by 1. What is 1 multiplied by 1? (looks round and waits for hands to go up) 1 multiplied by 1 its gonna be? .... Yes M.... | |
| 104 | | *Ignores incorrect answer* | M: 2 |

| | | | |
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| 105 | Elicit | T: 1x1 (hands up again) yes son.. | |
| 106 | | | L: it is 1 |
| 107 | Insert & elicit<br><br>funnelling | T: it is 1. Any number multiplied by 1 stays the same. Any number multiplied by 1 stays the same. 1 and 1 its 1. 1x2 its gonna be | |
| 108 | | | Chorus:2 |
| 109 | Elicit<br><br>funnelling | T: 1 x 3 its gonna be | |
| 110 | | | Chorus : 3 |
| 111 | Insert<br><br>elicit | T:Any number multiplied by 1 does not change,it stays the same. If your employer tells you you've worked very hard I'm going to multiply your salary by 1, it means I've multiplied your salary or not? | |
| 112 | | | Lrs: you did |
| 113 | Affirm & elicit<br><br>funnel | T: I did but is there any impact is there any change, think? | |
| 114 | | | Chorus: No |
| 115 | Insert | T:If you're earning R1000 multiplied by 1 it stays the same, its R1000 OK | |
| 116 | | | Chorus: Yes |
| 117 | Insert & elicit<br><br>deconstruct | T: Now my 1 comes here (*writes it in the hundreds column)* and this space here (*the units in the 2nd row*) we don't leave as it is (*writes in a 0*) and this becomes | |
| 118 | | | Chorus: hundred |
| 119 | Affirm & elicit | T: Why is it a hundred, who can tell me, why is it 100 yes M... | |
| 120 | | | M: cause you add the zero *(this is what he saw the teacher doing on the board)* |

| | | | |
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| 121 | Affirm & elicit | T: cause you add the zero. Why is it a hundred, who can tell me, why is it 100? Yes D... | |
| 122 | | | D: cause our..... says 100 |
| 123 | evaluate | T: no I'm saying this 100 (points to the board). Yes N.... | |
| 124 | | | N: mumble |
| 125 | Evaluate | T: no... how come we get 100 there | |
| 126 | | | L: mumbles |
| 127 | funnel | T: remember I said something about this 1 here. I said its not 1 its a ... | |
| 128 | | | Chorus: 10 |
| 130 | Insert<br><br>deconstruct | T: Its 10 because it is at a 10 what? Place. OK remember your place values, units , tens, hundreds, thousands... like that *(goes to the board and points to the 1 x 1* ) So when I say 1 x 1 its as good as what/? Its not 1x1 its in the tens place so its 10 x 10. Do you agree, do you understand? | |
| 131 | | | Chorus: Yes |
| 132 | | T: to a learner) do you understand | |
| 133 | | | L: yes |
| 134 | Insert & elicit<br><br>funnel | T: Sure? So 10 x 10 is 100 but only to simplify go 1x1but by the time you write your product here you will realise it was not even 1x1 it was 10 x 10. Now what do we do. We have multiplied by zero, we have multiplied by 1, now we do what... addition. Zero plus zero is | |
| 135 | | | Chorus: zero |
| 136 | Access funnel | T: Zero plus zero is | |
| 137 | | | Chorus: zero |
| 138 | Elicit funnel | T: nothing plus 1 is | |

| | | | |
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| 139 | | | Chorus: one |
| 140 | Insert & elicit | T: and that gives us 100 cents and we said 100c its equivalent to..? | |
| 141 | | | Chorus: one rand |
| 142 | | T: are we ready boys | |
| 143 | | | Chorus: yes |
| 144 | | T: sure | |
| 145 | | | Chorus: yes |
| 146 | 5:37 Insert<br><br>(could do this as an investigation) | T:One other short method of multiplying by 10 .its easy whenever we multiply by 10 you simply take the zero and you add it to the number . OK. Say it 2 x 10 what will I do.(*gesturing*) I take the zero from the 10 and i add it to the 2 ... 2 becomes what? | |
| 147 | | | Lrs silent |
| 148 | Access<br><br>funnel | T Repeats: *gesturing again* I take the zero from the 10 put it by the 2 2 becomes? | |
| 149 | | | L: a 20. |
| 150 | Affirm & elicit | T: the 2 becomes a 20. Any number boys, don't stress there. *Inaudible words of encouragement* In maths we're interested in how you got to the... | |
| 151 | | | Lrs : answer |
| 152 | Insert | T: Its pointless you knowing how to get to Johannesburg, to town but you cannot explain to someone how to get there. OK right OK You have to say take the bus from (names the area of the school) ...etc.... Like I said (draws 10 x 10 on the board) its easy you just take this nought here and put it there and the answer becomes 100.<br><br>10 x 10 | |

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| | elicit | 100 x 10<br><br>T: a thousand times 10 what do we do.Shows 1000 x 10 on the board. We just take the nought and put it there. And what number is that? A thousand becomes? X 10<br><br>A thousand becomes. Who can work it out for us? Yes M.... | |
| 153 | | | M: 100<br><br>*Bell rings*<br><br>*The girls have been at a talk and arrive and sit in the empty seats (not their own)* |
| 154 | Social norms<br><br><br><br>Elicit | T: Mm... sit down, we must be flexible in life. Thank you for joining us girls. You may not have your books in front of you.<br><br>We've just multiplied 1000 by 10 and I want to know how much that is. Yes M..... | |
| 155 | | | M: ten thousand |
| 156 | access | T: It is? | |
| 157 | | T & boys: ten thousand | T & boys: ten thousand |
| 158 | Evaluate & Insert (incorrect insert) | T:Yes. I want 10000 to be correctly written mathematically written. That is not 10000, it is something else. I want correctly written ten ... thousand. Alright my girl | |
| 159 | | | Girl writes 10.000 x 10 |
| 160 | Evaluates & elicits | T: excellent that is ten thousand. What is 10 000 multiplied by 10? Repeats the question. Right. First I want you to go and use the short method of multiplying by 10.and secondly I want the number to be read correctly.<br><br>Come come come. Yes.. | |

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| 161 | | | L: 100 000 |
| 162 | insert | T: No I don't want the 100 000 yet. I want the short method of multiplying by 10. Yes Al..., | |
| 163 | | | Al...: 10 000 multiplied by 10 .is... |
| 164 | insert | T: it is 10 000 multiplied by 10 but i want you to what... multiply by the short method. Yes alice quickly go. | |
| 165 | | | Al... writes out the long multiplication method 0n the board. |
| 166 | evaluate | T:No Al... that's quite long. Teacher rubs it out. | |
| 167 | Evaluate | | Al.. starts again and teacher rubs it out again. |
| 168 | Elicit from boys | Boys come help us. Yes Ts... | |
| 169 | | | Ts... draws a curve from the 0 to the 10000 but doesn't put in a 0.<br><br>10.000 x 10 |
| 170 | Elicit | T: are you done? Ts.. starts trying again.Come on Ts.. *(rubs out his 2nd attempt)*<br><br>T: to the class. Am I not here for 2 periods | |
| 171 | | | Chorus: yes |
| 172 | Elicit | T: Yes G come and do it my boy | |
| 173 | | | G comes to the board and puts in the 0 |
| 174 | Evaluate<br>Insert/access | T: very good, just take the 0 from the 10 and you add it to the number that you are... multiplying. put it ... OK | |
| 175 | | | Chorus: yes |

| | | | |
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| 176 | Insert<br><br>funnel | T: and simple example I said one multiplied by 10 just take the nought there and that becomes my answer<br><br>(shows 1 x 10 becomes 10~~x10~~.<br><br>1 times 10 is ten. 2 times ten is? | |
| 177 | | | Boy: 20 |
| 178 | Insert & elicit from girls | T: 20 like that (does the 2 x 10 becomes 20 x 10 ) Girls do you understand? | |
| 179 | | | Girls: yes |
| 180 | Insert | T: but it is only if you are not asked to show how you have worked out your answer. How you've come to solve the problem. OK | |
| 181 | | | Chorus: yes |
| 182 | funnel | T: say in a speedtest :10 x 10 | |
| 183 | | | Lrs: 100 |
| 184 | funnel | T: 100 x 10 | |
| 185 | | | Lrs1000 |
| 186 | funnel | T: 1000 x 10 | |
| 187 | | | Lrs: ten thousand |
| 188 | funnel | T: 10 000 x 10 | |
| 189 | | | Lrs: 100 thousand |
| 190 | Insert | T: 100 000 x 10<br><br>T: its gonna be one million exactly | |
| 191 | | Wipes the board | |
| 192 | Initiate | If Joan has 2 50 c pieces, 5 50c pieces and 10 10c pieces in his money box.<br><br>That problem can be solved by addition or multiplication, no subtraction or division. That is very much important when you do word problems. | |

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| | | I want to see how you have worked out your answer. | |
| 193 | | | T:What must be added to 105 to get 105? |
| 194 | Insert | T: *confused*. Repeats the question.<br><br>T: What must be added to 105 to get 150 | Some learners already calling out 50. |
| 195 | | | 45 |
| 196 | press | T: 45. How did you get 45 | |
| 197 | | | L:I subtracted 5 from 50 |
| 198 | Press | T: 5 from 50. Where did you get the 5 and where did you get the 50 | |
| 199 | | | Another L: you subtract 105 from 150 |
| 200 | Deconstructing<br><br>access<br><br>funnel | T: 105 from 150 cause here it says 'what must be added to 105 to get<br><br>One hundred and.....<br><br>50.<br><br>First thing, what do you do? You look for ?.... What do you look for? Cause you don't know what must be added to 105 to get 150. How do we get to know that its 45 that must be added to 105 to get 150?<br><br>Why are we subtracting 105 from 150? (*teacher wants the word "difference" from the learners*) | (boys calls out 50) |
| 201 | | | L: because we want to get the answer |
| 202 | access | T: OK discuss this in your groups.. why do we subtract 105 from 150. | |
| 203 | Insert<br><br>Into maths language | 6:01 *discussion with group*<br><br>T: so first thing you do is find the difference between 105 and 150.. for you to ask what must be added to 105 | |

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| | | to get 150 you are looking for the difference between the two and then you added it to prove your answer. No division , but multiplication but addition you can but only after you've subtracted. | |
| 204 | | | L: (Lu)You subtract 150 minus 105 to get the number which must be added |
| 205 | Into maths language<br><br>Insert / access | T: you subtract 105 from 150 the smaller one from the bigger one why are we doing that | |
| 206 | | | Lu: so that we can get the remaining number which can be added from 105 to get 150 |
| 207 | Into maths language | T:So as to get the difference. What makes the2 amounts what number differentiates the 2 the number that makes 105 to be 105 and 150 to be 150. The number between? | |
| 208 | | | 45 |
| 209 | Press<br><br>Elicit | T 45. How sure are you that its 45.<br><br>T:so 105 + 45 gives you 150 and you are 100% sure.<br><br>...Do we need to multiply | |
| 210 | | | No |
| 211 | Elicit | Do we need to divide | |
| 212 | | | No |
| 213 | Evaluate | T: well done girls<br><br>*Goes to another group* | |
| 214 | Elicit | T:What is your answer | |
| 215 | | | N: 45 |

| | | | |
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| 216 | Press | T: How do you know that your answer is 45? | |
| 217 | | | N:sir, because we subtracted 45 from 150 |
| 218 | press | T: why did you subtract 45 from 150? | |
| 219 | | | N:to get the answer, the number that we add from 105... (struggling to express himself) |
| 220 | Insert/elicit | T: now if I were to add OK 60 to 105 would I be wrong? 60 added to 105? | |
| 221 | | | N: no sir it would be over 150 |
| 222 | Insert & elicit | T: over 150 so 150 whatever is added to 105 must give us 150 so if I added to 105 10.it gives me | |
| 223 | | | 115 |
| 224 | affirm<br><br>press | T: its 115 ... so now how do we know that its 45? | |
| 225 | | | N:because we subtract 105 from 150 |
| 226 | Insert | T: so we don't divide so why are we subtracting | |
| 227 | | | N: because we want to get the answer, the number that we must add to 105 |
| 228 | Press | T: by subtracting 105 from 150. T: you're not convincing me yet. Why do we subtract. Basic operations Multiplic.... why did we choose subtraction. How does subtraction help you in this case? Can another group use addition to get the answer? | |
| 229 | | | Yes |
| 230 | Evaluate & insert | T: so you can use subtraction they can use division, they can use.... No you | |

| | | | |
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| | | can only use subtraction. You see M...., that can take you 20 years. Cause you gonna go 105 + 1 = 106 .....and 105 + 20 its going to take you a whole lesson. What you've used subtraction is spot on I want you to think why did you use subtraction.<br><br>*Goes to Another group.* | |
| 231 | | | L: 105 + 45 = 150 |
| 232 | Evaluate<br><br>press | T: that is perfect, I agree with you. Its 100 % now why did you subtract first. Why didn't you just look for the number that can be added to 105 to get 150 at once straight away. Why didn't you Go to Cape whereas you want to get to Johburg...... | |
| 233 | | | P....: we get 45 first before we add 45 to 105 to get 150 |
| 234 | | T: I'm not convinced | |
| 235 | | | L: stop blushing P.... |
| 236 | press | T: Right boys you subtracted, you subtracted the difference and it was 45.and you added it to 105 which is spot on. But I want to know your reason for subtraction. OK I'm coming back boys.<br><br>(teacher wants the learners to see that even though the question uses the term add, the sum can be done by subtracting. ) | |
| 237 | | | Another group – girls<br><br>Sir we said 150 minus 105 is 45<br><br>We said 105 + 45 is 150 |
| 238 | press | T:Excellent but why did you subtract first what is the reason | |

| | | | |
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| 239 | Revoicing | | L: *revoicing what teacher said*) Why did we do subtraction 105 fro 150 |
| 240 | | T:Yes | |
| 241 | | | So that we can get the answer |
| 242 | Press | T: so that we can get the answer. Was that the answer? | |
| 243 | | | L: not sure how to answer |
| 244 | Press | T: You are not convincing. One group can add so as to get the answer but you decided to use subtraction: why did you use subtraction | |
| 245 | | | L; Oh sir we did subtraction so that we could get the answer . |
| 246 | press | T: How do you know the answer will be 150 | |
| 247 | | | L: If we add it together we will get 150 |
| 248 | | T: Its correct but I'm not convinced.<br><br>answer. Yes Al.... | |
| 249 | Insert | T: to the class. The word problem itself will tell you where to start. Reads the question . You are likely to do want to do addition here but we don't want addition there, we want subtractionIn simple terms you are asked for the difference. It can be "what must be added to 105....150) and almost all of you have done the right thing subtracting first and after subtraction you got what the difference is 45 – you take the 45 and add it to 105 and it gives you 150 which is correct but now I keep on asking why are you subtracting and I don't get a | |

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| | Press | convincing | |
| 250 | | | Alice: we subtract the 105 from the 150 so that we can get the answer that gives us 150.. |
| 251 | Funnel | T: 105 + 45 but now how did you get 45, you must have subtracted. Al.... the word I'm looking for is not an "answer". You see when you say answer now you start confusing me. What are we looking for? Yes | |
| 252 | | | Al.....: we are looking for the difference |
| 253 | evaluate | T: excellent. We are looking for the difference because the difference is what should be added to 105 to get 150. Do you understand that? | |
| 254 | | | Lrs:Yes (chorus) |
| 255 | Elicit<br><br>Into maths language | T: we are subtracting because we want to find the difference between | |
| 256 | | | Lrs and teachers chorusing tog: 105 and 150 |
| 257 | Elicit | T: thats' the reason we are | |
| 258 | | | Chorus: subtracting |
| 259 | Elicit | T: because the difference added to 105 will give us | |
| 260 | | | Chorus:150 |
| 261 | | T: Are we all together? | |
| 262 | | | Lrs" Yes |
| 263 | | T: Do we understand one another? | |
| 264 | | | Lre: Yes |
| 265 | Insert | T: We are not subtracting to get the answer . If you say we're subtracting to get the answer.... then i'm lost, but if | |

| | | | |
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| | Into maths language | you say "Sir I am subtracting 105 from 150 because we are looking for the number that must be added to 105 to get 150" so we gonna subtract in order to get the ..<br><br>T and a whisper from a few learners: difference (LPP)<br><br>T: The difference added to 105 the smaller number will give us what? | a whisper from a few learners: difference (LPP) |
| 266 | | | Lrs: 150 |
| 267 | Written<br><br>elicit | T: 150 as a sum OK? so there it is what i want to ... this is what i expected from you (writes the sum on the board in vertical formation 150 – 105). Let us work it out. Where do we start subtracting? Do we start from the LHS to the RHS or from the RHS to the LHS? At....., where do we start? | |
| 268 | | | At....: Right |
| 269 | Affirm & elicit | T: we start from the RHS. Which side is the RHS? | |
| 270 | Insert which will create a misconception when they do integers | Now before we subtract,there's something very important we must do first, very important that we must ensure. What is it? With subtraction , hang on, hang on , hang on...do we start from this side (points to the right) or that side(points to the left), from the left hand side or the RHS. I'm confused now. | |
| 271 | | | RHS |
| 272 | Press | T: from the RHS to the LHS? I don't agree I don't agree . Why?. Yes Lu...... | |
| 273 | | | Lu: We start from the LHS |
| 274 | Elicit | T: to the.... | |
| 275 | | | Lrs: RHS |

| | | | |
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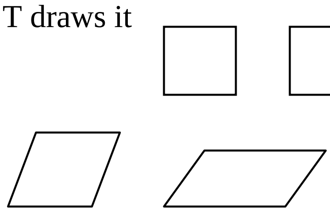
| 276 | Insert<br><br>elicit | T: Its unlike addition because in addition we start from the RHS to the | |
| 277 | | | Lrs: left |
| 278 | elicit | T: because in addition we're going to... why are we doing that- subtracting the smaller number this is our units ..... | |
| 279 | | | L: inaudible |
| 280 | elicit | T: no addition. Yes F....... | |
| 281 | | | F: for addition we can add a smaller number and a bigger number |
| 282 | Press | T: that I agree but why do we start on the RHS to LHS | |
| 283 | | | Lrs: for carrying over |
| 284 | Elicit | T: for carrying over from smaller to | |
| 285 | | | Lrs: bigger |
| 286 | Insert & elicit<br><br><br>(teaching a misconception) | T: That' it and here theres something very important that we must ensure before we subtract.something that you need to check for before you subtract | |
| 287 | | | L: That the bigger number is on top |
| 288 | evaluate | T: very good – that the bigger number is on | |
| 289 | | | Chorus: top |
| 290 | Access | T: that the bigger number is on.. | |
| 291 | | | Chorus: top |
| 292 | Access | T: OK because here for example there is a problem (goes to the board) . Can we take away 5 from 0? | |
| 293 | | | Lrs: No |

| | | | |
|---|---|---|---|
| 294 | Affirm elicit | T:No What do we do in that case? We're gonna... | |
| 295 | | | Lrs: borrow |
| 296 | Press | T: we're gonna borrow and how do we borrow – do we borrow from the smaller number to the bigger number? | |
| 297 | | | Lrs: No ... from the bigger |
| 298 | Elicit | T: So we start from this side (points to the left)<br><br>T: Can we take 1 away from 1 | |
| 299 | | | Chorus: yes |
| 300 | Elicit | T: can we take 0 away from 5? | |
| 301 | | | Chorus: yes |
| 302 | Elicit | T: But here,can we take 5 away from 0 | |
| 303 | | | Chorus: no |
| 304 | Elicit | T: so what do we do? | |
| 305 | | | Chorus: borrow |
| 306 | Affirm & elicit | T: we're gonna borrow . do we borrow here or there (points first to the 1 and then to the 5 in the tens column) | |
| 307 | | | Chorus; from 5 (teacher puts a 1 with the 0 and crosses out 5 puts a 4 ) |
| 308 | Insert | T: now we start doing what – we start with subtraction. Ten minus 5? | |
| 309 | | | Chorus: 5 |
| 311 | Elicit | T: 4 minus 0 | |
| 312 | | | Chorus: 4 |
| 313 | Elicit | T: 1 – 1 | |
| 314 | | | Lrs: one says 2 another says dash .<br><br>( teacher writes a dot in the |

| | | | |
|---|---|---|---|
| | | | hundreds column) |
| 315 | Insert | T: you cannot start a number sentence with a zero so we use a dot. Am I right.. and Mrs M........ is here | |

**APPENDIX 6: LESSON 1 REFILOE**

| turn | move | Teacher | Learner(s) |
|---|---|---|---|
| 1 | Initiate | T: Take out your maths ex book. Write todays date. Do not write the topic again. Please underline the date. .......<br>Give me examples of 2 dimensional shapes. 2 d shapes. | |
| 2 | | | L: a rectangle |
| 3 | Affirm<br>written | T: a rectangle (*T draws it on the whiteboard*) | |
| 4 | | | L:a triangle |
| 5 | press | T: a triangle. Is it the only 2D shape that you can think of. | |
| 6 | | | L: Circle |
| 7 | | T: we’ll come to that | |
| 8 | | | L:A rhombus (*T draws it*) |
| 9 | Affirm<br>Written | T: a rhombus | |
| 10 | | | L: (*inaudible)* |
| 11 | affirm | T: a trapezium | |
| 12 | | | L: a parallela... |
| 13 | written | T draws it  | |
| 14 | Affirm<br>Insert<br><br><br><br><br><br><br>elicit | T: a parallelogram. I want us to focus on these 2 for now, on these 4. We look at a square and a rectangle. We also look at a rhombus and a parallelogram (*Pointing to the diagrams of each of them she’s drawn on the board*). Let us focus on the square and the rectangle and give me geometric properties of the two. How do you see a square? | |
| 15 | | | *M:* all 4 sides are equal and all right angles are equal to 90 $^{\circ}$ all angles all 4 angles are = to 90 $^{\circ}$ |
| 16 | Evaluate<br>Access<br><br>funnel | T: (*firmly*) very good. It has 4 angles. Each angle is equal to $90^{\circ}$ and all sides are equal to each other.<br>OK. So if 4 angles are = to $90^{\circ}$ each, what is the total sum of those angles? If it has got 4 angles and each angle is $90^{\circ}$ or each angle is a right angle what is the total sum | |

| | | | |
|---|---|---|---|
| | | of angles in a square/ | |
| 17 | | | L: 360 |
| 18 | elicit | T: 360 what | |
| 19 | | | L: degrees |
| 20 | Affirm<br>Initiate<br>elicit | T: 360 degrees.<br>OK . And lets look at a rectangle. *(pointing)* Give me the properties of a rectangle. So we said this one has 4 right angle (*pointing to the square*) and all sides are equal to each other. Lets look at a rectangle. | |
| 21 | | | L: 2 opposite sides equal. 2 obtuse and 2 acute angles |
| 22 | Affirm<br>funnel | T: 2 opposite sides are equal to each other but what about the angles. Do we have 2 obtuse angles and 2 acute angles? | |
| 23 | | | Lrs: no no no (*not in chorus*) |
| 24 | Elicit | T: OK the hands are up – they say no – M? | |
| 25 | | | M: 4 right angles |
| 26 | Affirm<br>press | T: 4 right angles . So what is common between the square and the rectangle? What is common. | |
| 27 | | | L: they both have right angles |
| 28 | Affirm<br>press | T: both of them have got right angles.. but what makes them different from each other? I haven't heard a thing from this group. | |
| 29 | | | L: all sides are equal in a square and in a rectangle 2 opposite sides are equal |
| 30 | Affirm<br>Access<br><br>Initiate | T: all sides are equal in a square and in a rectangle 2 opposite sides are equal to each other.<br>Lets look at a rhombus. You said this is a rhombus and this is a parallelogram. OK. Properties of a rhombus. | |
| 31 | | | L: a rhombus has no right angles |
| 32 | press | T: It has got what type of angles, if it does'nt have right angles what kind of angles does it have? W.. | |
| 33 | | | W: It has obtuse and acute |
| 34 | press | T: How many of each? | |
| 35 | | | L: 2 acute and 2 |

| | | | |
|---|---|---|---|
| | | | obtuse |
| 36 | Affirm<br>evaluate<br>elicit | T: 2 acute angles and 2 obtuse angles. Very good. OK. How are the sides? | |
| 37 | | | L: It has 2 parallel sides |
| 38 | Affirm<br>press | T: OK it has parallel sides but the length of the sides ... length of the sides N | |
| 39 | | | N: they're all equal |
| 40 | Affirm<br>elicit | T: They're all equal to each other . OK Parallelogram? | |
| 41 | | | L: 2 sides equal |
| 42 | Affirm<br>Math language<br>press | T: 2 opposite sides are equal and parallel to each other. What else? The angles lets think about the angles of a parallelogram. | |
| 43 | | | L: it has 2 obtuse and 2 acute |
| 44 | Affirm<br>press | T: 2 obtuse and 2 acute angles. When we talk of obtuse angles, these angles lie between which degrees? They lie between 2 different degrees between which degrees. | |
| 45 | | | L: 90 degrees and 180 degrees |
| 46 | Affirm<br>elicit | T: 90 degrees and 180 degrees. And what about acute angles? They lie between what and what? What about other people? Ey M.... | |
| 47 | | | L: shyly 90 degrees and 180 degrees |
| 48 | evaluate | T: thats an obtuse angle, we're looking at acute angles | |
| 49 | | | L*: inaudible* |
| 50 | evaluate | T: No | |
| 51 | | | Another L: They lie between 90.. they lie between zero and 90 degrees. |
| 52 | Affirm<br>Access<br><br>elicit | T: They lie between 90 between zero and 90 degrees. All acute angles lie between zero and 90 degrees.<br>Obtuse angles lie between 90 degrees and | |
| 53 | | | One or two Lrs & T but not in chorus; 180 degrees |
| 54 | Initiate<br>deconstruct | T: So, if I look at my rhombus, who can come and identify 2 acute angles... from | |

| | | | |
|---|---|---|---|
| | | there.... 2 angles...so it means this angle lies between zero and 90 degrees – if I've got my angle, it means it has moved like this. (*showing with fingers*) Up to? | |
| 55 | | | L: 99 degrees |
| 56 | elicit | T: *ignores answer*. Who wants to give it a try? Come...n | |
| 57 | | | N comes to the board and colours two adjacent sides of the rhombus. |
| 58 | Affirm<br>press | T: OK N has highlighted the sides of the parallelogram I want you to mark the acute angles.Come on. Show us. Mark the acute angles. | |
| 59 | | | L; comes to the board and marks one of the acute angles |
| 60 | insert | T: It has got 2 opposite. Is it correct | |
| 61 | | | Lrs:Yes |
| 62 | Evaluate<br><br>elicit | T: good. So if these 2 lie between zero and 90 degrees what do we call these 2 opposite ones *(pointing to the obtuse angles*) 2 opposite ones. The other 2 lie between 0 and 90 degrees, what do we call the other 2? Z? | |
| 63 | | | Z: obtuse angles (*very shy and soft*) |
| 64 | Affirm<br>Written<br><br><br>Initiate | T: obtuse angles. Do not hesitate, don't panic Z, say it . they are obtuse angles. Marks them off on the rhombus on the board. Let us look at a square and a rhombus<br>What is common? What is common between a square and a rhombus? S? | |
| 65 | | | L: All sides are equal |
| 66 | Affirm<br>Math language<br>elicit | T: Both of them have all sides which are equal to each other. What is different? | |
| 67 | | | L: The rhombus has... parallel sides and the... |
| 68 | Initiate | T: OK Put your hands down.<br>10:35<br>T: what type of sides or what type of lines are parallel lines? | |

| | | | |
|---|---|---|---|
| 69 | | | L: lines that are next to each other but never meet |
| 70 | Affirm Deconstruct Access<br><br>Attributes to D..<br><br>press | T: lines that run next.. opposite each other but will never meet. So this side is parallel to this one. (*shows on the square*) and even this one is still parallel to the other one *(shows on the rhombus)* . So they both have parallel lines because this one (*filling in the arrows on the other 2 sides of the square and the rhombus respectively*) is parallel to this one and this one is parallel to the other one. So lets think of the sides. How are the sides? D said all sides are equal. Right All sides are equal in length,good, so what is different now…. K | |
| 71 | | | K: mam a rhombus has 2 acute angles and 2 obtuse angles and a square has 4 right angles. |
| 72 | Evaluate access | T: very good, a rhombus has acute angles and obtuse angles while a square has got 4 times right angles. K. What is the size of a right angle? ..inaudible… | |
| 73 | | | L: ninety degrees |
| 74 | Affirm Initiate | T: ninety degrees…. Now we're going to focus on 3D shapes. We have revised 2D shapes .Right. We're going to focus on 3D shapes. You've got examples of 3D shapes in front of you . Why are they called 3D shapes? K. | |
| 75 | | | K: Mam I think because you can see them from the different sides. |
| 76 | affirm | T: K. You can see them from different sides | |
| 77 | | | L: they have height , width and length |
| 78 | access | T:They have ? | |
| 79 | | | L: height, width and length (*louder)* |
| 80 | Evaluate Access Written (poster) | T: very good.K. They can be seen from different sides, can you all see this. (*puts a laminated small poster on the board titled 3D shapes with a picture of a cube on it and labelling height width and length)* | |

| | | | |
|---|---|---|---|
| 81 | | | Chorus: Yes mam |
| 82 | Insert<br>access | T:K. 3D shapes .. Every 3Dimensional shape has 3 measurements to describe it. It has got the height, it has got the length and the width. What do we call this 3D shape. What is it called? Read it! C | |
| 83 | | | C: a cube |
| 84 | Evaluate<br>Elicit | T: very good . So who can tell me , what does height stand for?... | |
| 85 | | | Silence |
| 86 | Insert | T: or if you look at this classroom , where is the height of this classroom, S | |
| 87 | | | S: from the floor to the roof |
| 88 | Elicit | T: from the floor to the roof, is it true? | |
| 89 | | | Lrs: Yes mam |
| 90 | Affirm<br>Press | T: OK that's the height of the classroom, so what does height mean? | |
| 91 | | | L: how tall something is |
| 92 | access | T: how | |
| 93 | | | Lrs : high , how high |
| 94 | Deconstruct<br>elicit | T: the measurement of the shape from the bottom to the | |
| 95 | | | Chorus: top |
| 96 | elicit | T: what about the length | |
| 97 | | | L: how long is it |
| 98 | Affirm<br>elicit | T: the longer side of the shape, how long the shape is, and what about the width? | |
| 99 | | | L: how wide is it |
| 100 | Affirm<br>Math language<br>insert | T: how wide, how broad the shape is. OK. So all 3D shapes have the height, the width and the length. Not all of them <u>the same</u> but they comprise of three or more faces. | |
| 101 | Initiate<br><br><br><br><br>elicit | Lets look at the shape that you've got in front of you and lets identify a shoe box – *points to one group*. You don't have a shoe box but you've got a ………….perfume box. K. What do we call that? Geometrically, what is the name of that shape? …………….. | |
| 102 | | | L: a rectangular prism |
| 103 | Affirm<br>Initiate | T: a rectangular prism. Lets look at the TOBLERONE . What is it called. L? I | |

| | | | |
|---|---|---|---|
| | | said you gotta go and buy the chocolates, I'll eat the chocolates and you can keep the box. I'm disappointed. What do you call this one? | |
| 104 | | | L: triangular prism |
| 105 | Affirm<br>Elicit | T: triangular prism. OK. Than you've got a dice, which group has got a dice OK a dice what is it called? | |
| 106 | | | L: a cube |
| 107 | Affirm<br>Elicit | T: a cube. And then you have a cooldrink can – what does it represent? | |
| 108 | | | L: a cylinder |
| 109 | Affirm<br><br>Initiate | T: a cylinder…. Let's look at the shoebox. How many sides do I see? How many sides, how many faces (*emphasise the word faces*) …. Faces (pointing to the different faces on the box)<br>K? | |
| 110 | | | K:6 |
| 111 | Affirm<br>Elicit | T: 6. And how many corners does it have… | |
| 112 | | | L: 8 |
| 113 | Affirm<br>deconstruction | T: 8 yes. You have to literally count them. 8 corners and how many edges? You'd rather remove the lid if the lid is going to disturb you. | |
| 114 | | | L: it has got 12 |
| 115 | Affirm<br>Elicit | T: 12 what do we call corners in geometry. The corners of a geometric shape | |
| 116 | | | L: vertex |
| 117 | Aff irm<br>Math language<br>Elicit | T: vertices. One is a vertex while more than one is vertices. Right lets look at the Toblerone. How many faces does it have? | |
| 118 | | | L; 5 |
| 119 | Affirm<br>Elicit | T: 5 faces how many edges does it have………… | |
| 120 | | | Lrs: some mutter 6 under their breath |

| | | | |
|---|---|---|---|
| 121 | | T: its not 6 | |
| 122 | | | L: one says 10 then one says 9 |
| 123 | Affirm<br>Initiate | T: 9 its 9………Lets look at the rectangular prism (*she holds up a shoebox without the lid*) and lets identify the nature of the faces, the type of 2D faces that you can see. What do you see? | |
| 124 | | | L: a rectangle and a square |
| 125 | Affirm<br>Deconstructs<br><br><br>Funnel | T: OK you've got rectangles (*points to them*) and you've got squares(*points to them) The 'squares' are not strictly squares but the teacher lets it pass – not sure if she's noticed that*.<br>So how many squares are there? | |
| 126 | | | L: 2 |
| 127 | Affirm<br>Elicit | T: 2 squares and how many rectangles? | |
| `128 | | | L: 3….4 (*seems unsure*) |
| 129 | Deconstructs | T: OK count them. Count the rectangles that you see. | |
| 130 | | | Same L: 4 |
| 131 | Affirm<br>Elicit | T: 4 who can tell me why is it called a prism, prism p r i s m hey, not prison (*class laughs)* why is it called a prism. Give it a try guys, (*hands go up perhaps in response to the encouragement rather than pressure)* | |
| 132 | | | L: you can see the inside |
| 133 | Positioning | T: K he says you can see the inside (*clearly not the answer she was looking for)* | |
| 134 | | | L: It has got 2 shapes |
| 135 | Elicit | T: It has got? | |
| 136 | | | Same L: 2 shapes |
| 137 | Evaluate | T: 2 shapes. Almost correct. | |
| 138 | | | L:It has to have more than 2 shapes. |
| 139 | Insert<br><br><br><br><br>Elicit | T: (*seeing the learners can't answer and instead of funnelling further)* The 2 opposite or the opposite shapes are the same so when we've looked at this (*shows box*) we've identified two faces..two squares *(pointing to them*) | |

| | | | |
|---|---|---|---|
| | | right, and how many rectangles | |
| 140 | | | Lrs: 4 |
| 141 | Affirm<br>Deconstruct for access | T: 4 so this one is opposite this one and this one is opposite this one. Do you understand? Look at the Toblerone box. | |
| 142 | Initiate | T:How many triangles are there. Triangles. | |
| 143 | | | L: 4 |
| 144 | Elicit | T: OK look at the box. Do you have the box in front of you. How many triangles do you see? | |
| 145 | | | Same L: 2 |
| 16 | Affirm<br>Elicit | T: 2 triangles right and how many rectangles N | |
| 147 | | | N; 3 |
| 148 | Affirm<br>Funnelling | T: 3 rectangles. Do you understand why is it called a prism. 2 opposite sides are.. | |
| 149 | | T *and some lrs*: the same | T *and some lrs*: the same |
| 150 | Elicit | T: How many vertices does the………triangular prism have? Vertices. G you look so sleepy whats wrong? | |
| 151 | | | L: 6 |
| 152 | Affirm<br>Elicit | T: 6 It has got 6 vertices, right? And how many edges? ….. Edges? | |
| 153 | | | L: 9 edges |
| 154 | Affirm<br>Elicit | T: 9 edges. How many faces or let me ask this question.How many faces. | |
| 155 | | | L:5 |
| 156 | Affirm<br>Initiate | T: 5 faces. Now we come to the cylinder and does that group have a cylinder? Now we come to the cylinder. How many faces does this cylinder have?...... Le.? | |
| 157 | | | Le: 2 |
| 158 | Evaluate | T: It can’t be 2, | |
| 159 | | | L: 3 |
| 160 | Affirm<br>Deconstruct | T: 3, right? Look at this face – it resembles what 2D shape? Which 2D | |

| | | | |
|---|---|---|---|
| | Elicit | shape can you see on this face? | |
| 161 | | | L: a circle |
| 162 | Affirm<br>Elicit | T: a circle. Does it have vertices | |
| 163 | | | Chorus: No |
| 164 | Affirm<br>Deconstruct<br>Elicit | T: It doesn't. At times when you look at a drawing of a cylinder it can be drawn and you think it has vertices. Edges? | |
| 165 | | | Lrs: no mam |
| 166 | Affirm<br>Initiate | T: no edges. Are you ready to do the exercise? | |
| 167 | | | Lrs: yes |

*Teacher hands out worksheets with grids which they have to stick into their books and then fill in.*

Properties of 3D shapes

| Item | Geometric name | No of faces | No of vertices | No of edges | Type of face (2D) |
|---|---|---|---|---|---|
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

Drawing shapes from different perspectives

| Name of shape | Bird's eye view | Side | Bottom | Front |
|---|---|---|---|---|
| | | | | |

*She waits for them to finish sticking the sheet in their books.*

| | | | |
|---|---|---|---|
| 168 | Norms | T: If you covered the date, just stick this and then you fill in the date correctly. | |
| 169 | Initiate | T: The 2nd exercise.. Have you all pasted the worksheet? | |
| 170 | | | Lrs: Yes |
| 171 | Insert<br>Elicit<br>maths<br>langauge | T: J we're waiting for you. OK you're going to draw the shapes from different perspectives. What does perspective mean? | |
| 172 | | | L: From different views |
| 173 | Affirm<br>Elicit | T: from different views, right. Bird's eye view you're going to draw which part? | |

| | | | |
|---|---|---|---|
| 174 | | | L: From the top mam |
| 175 | Math language Initiate<br><br>Elicit | T: from the top from the <u>aerial</u> position . Then the sides the bottom and the front, but you guys need to agree on how you're going to put your shape.so that you see almost the same side. And when you draw your shoebox, I'll suggest that you actually remove the lid, or…. You do not include this part…. So that you actually see what shape from the side. What shape do you see from the side. | |
| 176 | | | L: a square |
| 177 | Affirm Initiate Insert | T: a square. And then the first exercise says you list the item, you write it geometrically, you write the number of faces, the number of vertices, the number of edges and type of 2D face that you can identify. So if your group decides to start with this shape (*holds the perfume box in the air*) what is this item? | |
| 178 | | | L: A perfume box |
| 179 | Affirm Elicit | T: A perfume box, right? Geometric name? | |
| 180 | | | L: (*a bit of muttering going on in the class before a learner says*)rectangular prism |
| 181 | Affirm | T: rectangular prism. Right. C, number of faces? | |
| 182 | | | C: 6 mam |
| 183 | Affirm elicit | T: 6 M, number of vertices | |
| 184 | | | M: 8 |
| 185 | Elicit | T: 8 F number of edges | |
| 186 | | | F: 6 |
| 187 | Evaluate funnelling | T: No. *(She starts pointing to the edges of the box to help him)* | |
| 188 | | *(teacher smiles and goes to F to count the number of edges with him)* | F: 9 no 8 … 10 *(laughter and* |
| 189 | Funnelling | T: 1 , 2, 3, 4, count with me.. 5, 6, 7, 8, | |
| 190 | | | F: 12 |
| 191 | Affirm Norms | T:From 8 you go straight to 12. So its 12. Do you understand what you're supposed to do in both exercises? | |
| 192 | Checking norms | | Lrs: Yes mam<br>L: Mam can we start with anything? |

| | | | |
|---|---|---|---|
| 193 | Norms | T: yes you can start with anything? | |
| 194 | Checking norms | | M: can we work together and decide on which shape to start with. |
| 195 | | | *In the group*<br>L: How dyou spell that chocolate thing again<br>L: tobrone<br>L: counts 1,2,3,4,5 (*faces of a shoebox without the lid*) |
| 196 | Insert | T: but what about this one now (*referring to the lid)* | |
| 197 | | | L: yes mam, |
| 198 | Insert | T:the one that would have covered | |
| 199 | | (*T chuckles*)<br>*Teacher moves around the classroom and draws their attention to something after a few minutes.* | L: mam should we, ya mam we add that top one, mam she's adding the inner instead of the top one. |
| 200 | Insert | T: grade 6 listen. You need to be specific when you write the 2D shape that you can identify from the 3D. You need to be specific on the number of things.e.g. with the rectangular prism, how many square faces and how many rectangles.<br>……………. | |
| 201 | English language | T: Is it a rectangle prism or a rectangular prism | |
| 202 | | | Chorus: rectangular |
| 203 | Provides the maths language | *Teacher going around helping learners to see what's expected – she says "from the bottom , from the top, from the side....* | |
| 204 | Initiate<br><br><br><br><br>Maths language elicit | T:Lets mark the first excercise. You're going to write your items differently but you just look at your grid where you've written the items.We'll start with shoe box. Geometric name of a shoebox? (*seems to be looking for the answer from someone who is weak* ) | |
| 205 | | | L: rectangular prism |
| 206 | Affirm<br>elicit | T: rectangular prism. Number of faces,... G | |
| 207 | | | G: 6 faces |

| | | | |
|---|---|---|---|
| 208 | Affirm elicit | T: 6 faces, number of edges. Mf | |
| 209 | | | Mf: 8 |
| 210 | Affirm *(but incorrect)* | T: 8 | |
| 211 | | | Lrs: no no |
| 212 | Insert Elicit | T: sorry, number of faces (*should be vertices?)* is 8 number of edges, Pr | |
| 213 | | | Pr: 12 |
| 214 | Affirm elicit | T: 12 Type of faces that you see .. O | |
| 215 | | | O: square and rectangle |
| 216 | Elicit | T: How many squares | |
| 217 | | | O: 2 squares and 2 rectangles (muttering from the class) I mean 2 squares and 4 rectangles |
| 218 | Evaluate Elicit | T: K 2 squares and 4 rectangles. Good. The toblerone. Geometric name?C | |
| 219 | | | C: Triangular prism |
| 220 | Affirm elicit | T: triangular prism. Number of faces ,K? | |
| 221 | | | K: 5 |
| 222 | Affirm elicit | T: 5 Number of vertices Ma | |
| 223 | | | Ma: 6 |
| 224 | Affirm elicit | T: 6 Number of edges Z | |
| 225 | | | Z: 9 |
| 226 | Affirm elicit | T: 9 Number of faces that you see, Ts number of faces that you see, Y | |
| 227 | | | Y: 3 rectangles and 2 triangles. |
| 228 | Affirm elicit | OK dice. Geometric name of a dice | |
| 229 | | | L: cube |
| 230 | Affirm elicit | T: cube Number of faces, M? | |
| 231 | | | M: 6 |
| 232 | Affirm elicit | T: 6 number of vertices, K | |
| 233 | | | K: 8 |
| 234 | elicit | number of edges, Fx | |
| 235 | | | F: 12 |
| 236 | Affirm | T: 12 type of faces , R | |

| | | | |
|---|---|---|---|
| | elicit | | |
| 237 | | | R: 6 squares all round, 6 squares all round |
| 238 | Affirm elicit | T: 6 squares, a can or some of you have got glue... Cx | |
| 239 | | | C: a cylinder (*knows the teacher is expecting her to name the shape)* |
| 240 | Affirm elicit | T: a cylinder , number of faces , Px | |
| 241 | | | P: 3 |
| 242 | Affirm elicit | T: 3 number of vertices, Le | |
| 243 | | | Le: none |
| 244 | | | |
| 245 | Affirm elicit | T: none, zero, number of edges , Y | |
| 246 | | | Y: zero |
| 247 | Affirm elicit | T: zero Type of faces , Mi | |
| 248 | | | Mi: circles |
| 249 | Affirm Elicit press | T: circles how many... *confusion in the class about the body of the can... someone says square others shout out rectangle* How is it in shape? | |
| 250 | | | L: circular |
| 251 | Affirm | T: circular shape | |
| 252 | | | Lrs: 3 circles |
| 253 | Affirm *(but not correct)* | T:a circular shape and 3 circles | |
| 254 | | | Lrs; Yes (*excited)* |
| 255 | Initiate | T: K lets continue *walks around interacting again.* | |
| 256 | | | *N's group working with the die say everyone's going to get 6 .* Na: what's the front I mean the bottom. |
| 257 | | | Ts: the bottom is 6 |
| 258 | | | N: oh ya |
| 259 | | | Ts: Let me see all the sixes |
| 260 | | | N: so what;s the front |
| 261 | | | Ts: minus 5 ....... no |

| | | | |
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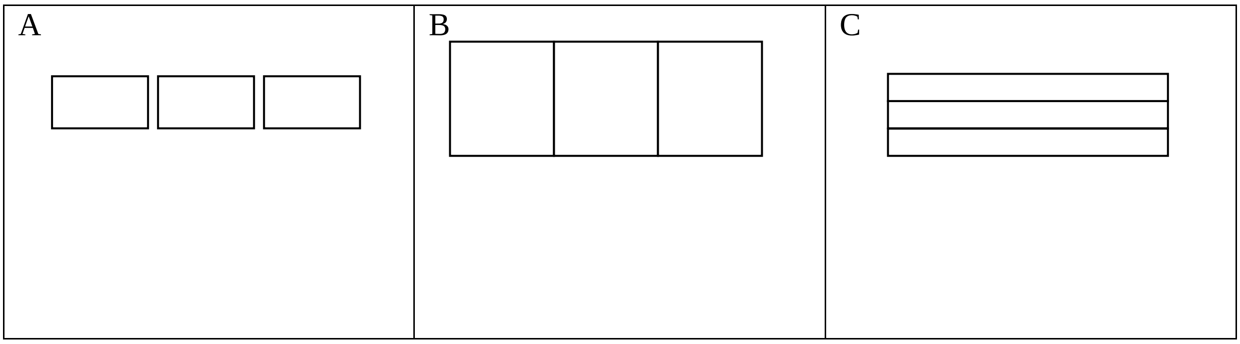
| | | | minus 3. |
| 262 | Initiate | *T*: *to a group*. What do you see from the side- do we see a 3D or do we see a 2D shape? | |
| 263 | Initiate<br><br><br>elicit | *K has drawn a 3D shape for the side view – T trying to help her to see that you can only see a 2D shape*<br>T: K, the rectangular prism from the side do you see it as a 3D shape ....... or... do you see it as a square | |
| 264 | | | K: from the side mam |
| 265 | deconstruct | T: OK this(*pointing to K's answers*) was your bird's eye view , so it was a rectangle. From the front (turns the box and points to the front of the box) its OK. From the side do you see it as a 3D when you look at it from the side (*T turns the box so that the side is facing K)*this was your side – if you were to come this side and look at it from the side would you still see it as a 3D shape. | |
| 266 | Initiate | *Teacher starts to hand out another worksheet with 3 boxes packed together in 3 different ways.* | *K erases the 3D shape in her table. Si.. starts erasing as well. He has a few 3D shapes in his table*. |




*Widths tog* *lengths tog* *heights tog*

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| 267 | | | Lrs*: recognise that they've done this work before – last year. Chat about it.* |
| 268 | Initiate | T: The worksheet that I've just given you. Please paste it flat in your excercise books on the left space. Kw, I've just said please paste your worksheet flat..... K lets look at the worksheet that you've got now...................... Pasted already. | |
| 269 | | | K: Yes mam |

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|---|---|---|---|
| 270 | Initiate | T: We're waiting for Mi... K.. on this worksheet there are three boxes. They've been stacked differently , right? You've got stack A stack B stack C. Then you are going to say.. when its under that question you are going to make a table so you have column A column B column C, right? You've got numbers 1 up to 10 Then you're going to identify it on which view do you see number 1 so when you're looking at those 3 stacks, number 1 is it the top view, the bottom view or the side view? | |
| 271 | | | L:side |
| 272 | Aff | T: the side view, right? So you will have | |
| 273 | | | L: *whispering* we did this last year |
| 274 | Deconstruct for access | T: *cont.* Number 1 then.. so you will have numbers 1 up to 10 you've got the stack you will say that is stack A and then you identify the view where you see that. Do you all understand what I want ? | |
| 275 | | | Lrs: yes mam |
| 276 | | T: So, three columns | |
| 277 | | | *Learners are still busy with the first worksheet so they go back to it* L: mam we need our toblerone |
| 278 | | T: and what's happening here, hey...whats this (*pointing to the side view of the can)* | |
| 279 | | | L: it looks curved |
| 280 | Norms | T:so untidy | |
| 281 | | | L: mam all you see is this |
| 282 | Insert written | T: grade sixes. So you've got number, stack of boxes and the position of the view.(*T has written the titles for the columns on the board)* | |
| 283 | | | L: mam |
| 284 | deconstruct maths language | T: so do you see it as lines going down or do you see it as horizontal lines................. do you see it as vertical lines or as horizontal lines.. so put it down | |
| 285 | | | *Si is still drawing 3D shapes for his views.* |
| 286 | Initiate | T:OK I'll suggest that you stop and write | |

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| | | the topics for your table because we're left with 2 minutes.  So you've got number, stack of boxes and position of the view. Then you write in your homework diary that you need to complete your work for homework especially the third excercise | |

PRISM

| Number | Stack of boxes | View |
|---|---|---|
| | | |
| | | |

*Bell rings*

## APPENDIX 7: INTERVIEW PROCESS AND SCHEDULE

Two teachers will be interviewed individually in an attempt to explore interactively what they think about what they are doing. The interviews will be open ended and aimed at developing discussion around RV as a strategy. Excerpts from transcripts of the lessons will be shown to the teachers as a springboard to revealing and discussing their understanding of their teaching practice in relation to learners' appropriation of mathematical discourse.

The format of the interview will develop organically depending on the responses of the teachers. At the same time the interviews will be loosely informed by the following questions:

- What strategies do you use to develop mathematical ways of talking in the classroom?
- What strategies do you use to develop mathematical thinking amongst your learners?
- How can ESL learners develop the required ways of talking about mathematics?
- How do you think you can assist all learners but ESL learners in particular, to succeed?
- Do you think that you are using repetition of words or ideas which learners verbalise, and if so how do you use it?
- Do you see it as a helpful strategy for ESL learners?
- Do you think that you are using rephrasing of words or ideas which learners verbalise and if so how do you use it?
- Do you see it as a helpful strategy for ESL learners?
- Background Information
- What languages do you speak?
- Which one is your first language?
- What languages do your learners speak?

**APPENDIX 8: Interview with Bongani**

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| J:Tell me a bit about yourself – not for my research |
| B:I'm Bongani. I went to the University of Venda for tertiary – BA Ed<br>Other institutions were doing BA and then HDE. BA ED is education all through<br>......... I went to Venda up to 1996.Then to Soweto teaching Maths and English up to 2000. I found myself moving from one school to another – this is my 6th or 7th school.<br>........<br>It's only this year that I came back here.<br>........................................ |
| J: So now my 2nd question. What ways do you think you can help learners to develop mathematical thinking. I don't know if the language of that question is a bit…. Whatever you understand by that. |
| B: Like I said off the record – I'm going through this gymnastics of the mind. I think it's a brilliant approach but what I've been using so far is to try so far is to try and dwell so much on the basic operations out of nothing and that is where the language comes in because thru my years of teaching I've realised its not the maths that is difficult, it's the way we teach it. We're very much interested in seeing them do calculations you know additions divisions but when they have to apply that in a real like live situation it's a problem. 9 out of 10 times when you do revision .. you know they start you can see that they could have easily managed the sum or got answers right but it is because they do not understand it within the context. Once it is more (interruption). This is why when you notice I dwell much on word problems because you can easily detect that they've understood then they can use it no matter how the question will come. They understand maths terminology – all together now they know once its all tog they're going to add, quotient they 're going to divide. They find it very difficult cause one minute you are adding subtracting its fine but bring it in a context and its very difficult. Its something as a teacher I think I need to be developed on cause once I master that I know I will definitely make an impact. As of now it is a challenge. You might have realised in one of our lessons they were battling with words such as fowls. They didn't know what a fowl is and you can imagine such a question coming in a common paper where they're being invigilated, you cannot even explain – it means the child is going to fail because of the language because the moment they realise this is just a bird they know all birds have 2 legs… and not they they can't add… but what is this. |
| J:The context…<br>What ways do you think you can help learners develop mathematical ways of talking in the classroom? |
| B: Silence…. I. |
| J:That's more than just giving the answer as a number so I suppose its like explaining themselves- that's whats referred to as a mathematical way of talking.... How they got the answer |
| B: I think even though I was not very much aware of what I was aiming at or the objective but this is what I like specially when I teach maths . to find out that many a time these kids guess and its not easy for you as a teacher to find out whether the child has understood or not …for an example we had.. subtract the difference between 9 and 7 from their sum … you remember that one. Its easy for these children to just subtract, they just subtract from where they … and its only when you start asking questions how did you get it, what is your understanding of this word problem .,that's when you realise |

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| oh they did not understand it fully. They only took it from subtraction and they could not get to the sum, meaning that they had to add the 7 and 9 first before they could take away. What they did , they just subtracted 7 from 9. |
| J:They just look for the bigger number and the smaller number |
| B: Exactly, exactly and it is only when you engage them by asking them how and why that's when you feel at the end of the lesson yes, about 2, 3, 4 children understand exactly what's happening but if as a teacher you're just interested in answers that's where you're running a risk of losing everyone. |
| J:I notice that you ask learners a lot of questions, what's your thinking around questioning? |
| B: I'm trying to eliminate guesswork like I said. A child cannot easily put up her hand and say the answer is 7 because they know they have to explain why is it 7, can you explain how you got your answer. So ,even if it is a very simple sum, but I still want to engage them so that they get used to the explanation, the way they or the method they've used to.. their understanding of the question |
| J: So they know that you're going to question them |
| B: They do (laughing) |
| J: They know they have to back up their answers |
| B: I'm afraid some get easily intimidated even if they know the answer because they know there'll be a why and what and they decide not to answer . I don't know how I can try and eliminate that because sometimes I can see this child has an answer but he's not confident to raise their hands because they know they will have to – so in the process you only get those average and above average children to participate in the lesson so that is one of the weaknesses of my approach – but how, I don't know how to get everyone on board? |
| J: Are most of your lessons run in this way or if I came last year would it be a similar sort of lesson or would you have run it differently? |
| B: I prefer this way like I said ..some children get easily intimidated so this is why at times I give them work without any questioning further , we take it from there, we mark together or I mark alone and that is when I realise that Oh this child is not quiet in class because he doesn't understand or she doesn't understand its because he's…. so I try and accommodate them and I still find this very time consuming , questioning, because on the other hand you have a file, a work schedule that you must…and at the end of the day you start lagging behind with your work. By the time you check your work schedule you are doing what you should have done 2 weeks ago. That's the problem. |
| J:So how do you decide on pace, how much to question, when to leave it? |
| B: Silence….I don't have a precise answer for that but spontaneously it will happen. I will feel now we are running out of time . Let me stop the class now and explain . We are not very much happy with that but the kids say you are the teacher and you should know. They are not very much interested but they are more interested when the answers are from themselves. Yes |
| J: So you're working with learners whose English is not their language so how do you work with these learners to develop the required ways of talking in maths. Do you have a special way that you handle the words… parallel…. You know the mathematical language . Is it difficult for them… how do you handle that? |
| B: It is difficult, I must be honest and its maybe something that should be looked at especially the mathematical dept nationwide because I'm comparing the schools and the places in the sense that I'm from ..... (a rural area) and I'm now in Gauteng at the formerly model C school where it is much better compared to a rural child – you know |

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| its not an easy thing to teach maths . The fact that its English and the poor child only interacts with the material in English in class . During break its something else, at home its something else .. it is a big challenge and I still find it a problem even here at this very school tho in comparison its much easier here because you can give them word problems. Its only a few that will find it difficult to understand but if you give the very same work to a child who is in a rural school.... I think even here in Gauteng if you go to a rural or a squatter camp school , it's a problem but I find this Instamaths I like it, so what I do… whatever I'm doing they still do their word problems so what I do is maybe in the week depending on how much work we've covered, if we didn't do much, then it'll be 10 or maybe up to 15 word problems that they take home and within 3 or 4 days they must bring the work answered and that's where you try and work with the language because I looked at this national assessment. I've worked out that there is a certain % that without the language you cannot answer. |
| J: They call it problem solving, its about 15% |
| B: So that 15% you know there's about 70% of the learners that are not going to answer that one and that's where I think we're failing as maths teachers but how do you solve the language problem but maybe the department has realised as well . I think there was a time when they were advocating for home language<br>They should start in FP cause when they get to tertiary they might be taught by someone who is English speaking and they must be able to understand and learn in English. This is why there's this discrepancy between urban and rural child. |
| J: I notice that you use repetition of words or ideas that learners verbalise so after a learner says something you might repeat what they say or you often ask a question using their form of English language so can you just talk a little bit about that. Are you conscious of doing it or… it just comes? |
| B: When I started.. |
| J: Do you want to see an excerpt cause I've transcribed your lessons.. but carry on.. |
| B: Yes, when I started I will do it unconsciously but later on I realised that it is very important for me to reiterate or repeat what the child has said in order for that very child to internalise and for the other children that might have not heard or understood, to benefit . I ask a child to read the question or the instruction and the child will read and before we can interact with the question, I repeat the question and that way I think I'm helping the children to internalise because some are not even listening and even the very same child might have read just for the sake of reading but when I repeat it then they start thinking this is very important and they listen so they're not hearing the word for the first time, they heard it twice or 3 times in a lesson which I think it's a very good idea and it works |
| J: so you're doing it for the benefit of the learners. Do you think its for the benefit of the learners because its 2nd language English or would you also do it with English speaking children? |
| B: I will still do it with English speaking children but I wouldn't overemphasise like I'm doing with the… |
| J: so a little bit less but you'd still do it |
| B: Yes |
| J: Here's an example: "What do we call it, the answer when we divide . L: a remainder. T: Is it a remainder? L: its called a quotient " So what do you think you were doing there? |
| B: No I think its to do with the language. The child does not give the correct answer simply because he's not familiar with the language. Obviously the one that gave "the |

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| remainder" as the answer it means that the term or the word quotient in that context the child could not have… because the child could only answer me because I said divided but that child if the question was to come in this way: "What is the quotient of 4 and 2?" It means the child , the one that gave "the remainder" as the answer, that child wouldn't get the answer, that is why I wanted the correct terminology and I still made it a point that I explain and maybe repeat the word so that's a problem, only when you do corrections and they say "AH AH" it means that that was easy – 4 divided by 2 but it didn't come that way, it is the quotient of 4 and 2 so that word quotient so the child would know I'm going to divide . The only child who could get that one right is the one that knew what a quotient is – the answer we get when we divide is a quotient. But the one that gets a"remainder" it means was only helped by the word divide in the question |
| J: He knew that somewhere there's a remainder – just chooses a word connected to division. |
| B: And if we're answering it means that that child would have written the correct answer, the one who wrote"the remainder" but she doesn't know that the answer is not a remainder but she knows that we divide here. And if we were to test them with only number sentences like 4 ÷ 2 the whole class gets the correct answer but now when it comes to the context the whole class gets for the very same question they get (inaudible) |
| J: so you're just pointing out the importance of language |
| B: True |
| J: OK I noticed something else here . You said "What are we still looking for, we're still looking for something, what are we still short of? The learner says 'the price ' then your response to that was " the amount of money that is still owed, how do we get the outstanding amount?" So now you weren't repeating. You didn't say 'the price' , you said 'the amount of money that is still owed' |
| B: Ja |
| J: so what were you doing there? |
| B: This is where you try and use the language as much as possible cause you'll still say the price OK he understands the price but the very same question comes its not asking for the price. It's rephrased, the language is different – what is the outstanding amount not what is left on the…which is a problem and that's why I'm saying its not easy but at least now I know you and I'll always check with you for advices and all of that but it's a problem teaching maths because of the language . If you look at the national assessment or the common task, you hardly get questions such as "use the long division method to solve the following" where the child can easily show you the method – they don't look for that . Its less than 5% and that's where most of our learners are working very well . |
| J: the procedures |
| B: Exactly, but bring language in, it's a problem it's a problem |
| J: so is that another strategy that you use? Like hear when the learner said the price, you elaborated on what price is – the amount of money that is still owed and how do we get the outstanding amount. That's what you seemed to be doing there. And then straight after that you said "I can see blank faces" so do you think they didn't understand your elaboration ? |
| B: I was not happy with the response because –you know if they understand something you'll see this wide smiles and the body language tells you but after you've explained and they still – that's when as a teacher you feel you haven't reached them and it's not an easy thing because as well English is not my home language and some of the things I still find challenging as a teacher I have to stop for 2 minutes, you might have noticed at some point we even used a dictionary . I asked them to check the word fowls because I |

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| was scared to just impose my understanding of the word without double checking . I knew what's a fowl but for me to reach out and make them everyone understand what kind of an animal or creature it is, it was difficult. So after we've read from the dictionary I felt at ease and I could see smiling faces and Ah Ah cause they mistook it for a horse cause a horse they know its got 4 legs and they thought maybe its some kinds of horse |
| J: the baby horse is a foal f o a l . I thought that you were talking about a foal .. (laughing tog) |
| B: You see, its very tricky meaning that if that question was to come – excuse me is fowl pronounced the same? |
| J: That's fowl and the baby horse is a foal. |
| B: OK |
| J:So how do you cope with learners who don't understand the English at all? Do you just tell them or….? |
| B: I't a nightmare, I must be honest. I have a child in 6B I understand she only came this year or last year from rural areas and it's a problem . You can see the progress but its very very slow and what I like is that she's very confident but the language will always put her down and you can see she's not where she wanted to be |
| J: where she could be |
| B: Where she could be, you see it's a problem. And those are the cases I feel I'm not making an impact, a good impact on and it worries me as a teacher. You know throughout a lesson a child will choose to play or draw things and no matter how you… because the child is not coping at all. |
| J: I imagine it must be very difficult because even if you're English speaking maths is something you've got to think about, you've got to apply your mind, its intense. Now if you've got to think from your home language into English back into your home language, that's double the intensity. It must be exhausting! |
| B: Definitely! It is. |
| J: I remember from the 1st or the 2nd day a strange thing happened. The R247,84 they were saying 247 thousand…. Did you ever manage to resolve that? What do you think was going on? |
| B: You still have children and its worrying cause these are grd 6s, who cannot read number sentences . You are expecting them I think at their level its up to 100 million I should think so , evenup to a billion yes but they still find it very difficult. But that one I think was a very unfortunate situation, I can't recall it well but I remember that one was an easy small number and for them to.... |
| J: It was towards the end of the first day , here, the tyre of a tractor costs R247,84 , how much will 3 such tyres cost? The learners all said R247840.00 and then one learner said it correctly. |
| B: After wards |
| J: So now when a learner gives an incorrect answer, do you think its worth time discussing why its wrong or do you prefer to spend time on the correct answers? |
| B: I think it is very important to go back to the incorrect one unlike ignoring the child and going to the next child then get the correct answer and move on, because it means that one is left out . It is best to explain why the answer is incorrect and move from there because like I said earlier on a number of times these kids they guess . When they don't know the answer they will still put up their hands and at times they get it right . For you to ignore the incorrect and concentrate on the correct one , it might be a guessed answer |

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| as well. It might be a problem but if you go back I think that way you’ve eliminated the guesswork and at the same time you benefited the child that was struggling |
| J: Do you think it also benefits the rest of the class if you explore what was wrong |
| B: Yes, exactly because the child who got it right might have correctly used a different method, but if you start discussing that you are likely to come up, like as a teacher a number of times I get a different method from... we get the same answer but we’ve used a different method and when you check – “no my uncle helped me” specially when you check homeworks my uncle helped me, my mum helped me. As a teacher you benefit at times. |
| J: so you accept different solutions |
| B: Yes |
| J: How do you know when learners have grasped the word e.g. difference or some other mathematically correct way of saying something? |
| B: Its when it is used in a context and they get the answer correct- then I know they understand now like with division you cannot celebrate after you’ve done the operation, the method everything without checking especially in a context because your 90% pass can come down to a 20% pass in a common paper for instance specially where language has been used . I feel more happier when for an e.g. you’re doing division and a number of division terminologies have been used |
| J:By the learner? |
| B: In the question. |
| J: Oh I see. |
| B: That’s when I feel my learners have grasped but it is not an easy thing though to measure- its not easy. |
| J: OK my last question is do you rephrase learners words or ideas and do you think this or how do you think this could help learners? |
| B: Rephrase? |
| J: Like say a learner says “lines which go like this” |
| B: Oh yes We say no, in maths we haven’t said anything to say “lines that go like this” in maths we have the language that we use “that go parallel” Is that what you’re referring to. Yes |
| J: I think it was a little bit like that 2nd one I asked you when..<br>• the learner said the “price”<br>• and you said the “amount of money that is still owed”.<br>It’s a little bit different from what the learner was saying. The learner was a little bit far from what you were trying to get to. |
| J: Lets see if we’ve got some other examples.<br>J: this one is the train that was supposed to come at 5 to and it came at quarter past – ooh you read it many times. |
| B: Yes I remember (laughs) |

J: If I look at what you do , you take what a learner said and you turn it into a question e.g. a learner says ‘ because it has to arrive 5 minutes earlier’ so then you don’t repeat it but you partly repeat it but in a question form. “Was it 5 minutes earlier?” and then you read it and you say lets read it again.
J: Every now and again you say good or very good but that’s not your style generally to say that
J: OK

- learner says ‘at quarter past”
- and you say “at quarter past? Was it supposed to be there at quarter past or is it **at** quarter past?”

So there you were rephrasing and it was a very interesting thing you were doing there. You were using what the learner said & turning it into a question but also reformulating it.

  - ‘It arrives at quarter past and what time was it supposed to arrive at?’
  - And then they said ‘at 5’ to

.......so they understood. Then a learner said something that you didn’t follow up on.

- A learner in one of the groups said 20’ which was the correct answer
- ,then you repeated 20’ and then you said ‘how did you get 20’?’
- And the learner said we plussed 12 +5 .

I thought “where on earth does the 12 come from.... but actually it comes from the clock . At midday its 12 o’clock and then plus 5 would be minutes and then it gives us 2 + 5 which is 7 cause I really tried to think, how does this learner?
Because usually when learners give answers theres a reason for it. And you didn’t follow up on it so I also couldn’t tell from that.

B: I thought the child was totally lost and how do i and I had to move on for maybe another answer that will make the child.... but now that you are saying

J: It might have been a good thing to explore

B: Ja true

J: Because you were often when you looked at the clock you were often saying it was supposed to come at 5 to, 5 before twelve so just add 5 to 12 and then the 2 and the 5 I don’t know where that came from
J: and the 745 that was interesting. Sometimes when the learners get the answer and then you try to backtrack its quite difficult, its quite difficult to get them to backtrack

B: Yes

J: And you say to them

- ” No but we haven’t got the answer yet” What would you do if you didn’t have the answer –

I think that’s part of your strategy. And then there was one with the half and they were getting mixed up with the quarter and the half. Why are we taking it away? The learner says

- “ to know the ½ of 2380.
- Teacher says “ to know the ½ there’s no ½ where do you get a ½ ? We know what the ¼ is, we did it yesterday by dividing 2980 by 4. How does the 745 help us to the answer?

So you kind of wiggled away from the ½ to the ¼ .

J: Alright so maybe any more thoughts about repeating what learners say . Maybe you could talk a little bit about something which we call “press” where you ... there are a

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| whole lot of different ways in which teachers ask kids or respond to kids and what I think you did a lot of was “press” – pushing them to explain themselves and you did some rephrasing and your repeating you linked to questions |
| B: OK |
| J: I don’t know if you’ve got anything else to add |
| B: No |
| J: We’ve exhausted the topic. Well, as I carry on analysing I might ask you if I can talk to you again. |
| B: With a pleasure. I think your visit has helped me a lot to realise some of the things that I’ve been doing unnecessarily and the things that I think I should do more . If you don’t mind when you have time to give me a full critical report. I’m glad you’ve highlighted some of the things but if you have time. |
| J: You’d like some feedback. I’m happy to do that |
| B: Please call that will help me and please as critical as possible |
| J: That’s great because that’s the way we learn |
| B: It’s nice to get good and excellent |
| J: But we want to know “how can I be better” |
| B: Ja |

**APPENDIX 9: INTERVIEW WITH REFILOE**

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| J:What I'm interested in is the development of mathematical language of the students and how one goes about that. And I notice that you do actually focus on it - .....I can tell that from the way the learners respond to what you say.... Maybe you can just tell me a little bit how you view language. |
| T:Probably its because I taught at high school before and in most cases we found the learners lack the mathematical concepts, the right concepts to use, so I'm coming with that experience to primary. In most cases I do extend them a little bit further but... I'm pro-Maths and I want them to know that mathematics is a science on its own and it has got its own specific terms, its own terminology |
| J:Its own language..... just keep going... don't depend on me for what you say... So what strategies do you use to get them to learn the concepts and the language.I mean, I'm not sure if they're the same thing. Sometimes they are but sometimes the language is just a name, sometimes its a concept |
| T: In most cases I start from the known to the unknown for e.g. If I'm teaching them properties of 3D shapes and I want them to identify the **vertices** I will start using the word **corners** and the sides and then introduce the correct words so in future they don't say the corners but they say vertices |
| J:OK so are they more likely to understand corners |
| T:They're more likely and what I've seen is if you keep on referring to corners when the question comes and it says vertices there most of them will have a problem so if you **instill** the correct concept in them in most cases you won't have a problem. You will still have a problem there and there but the majority will still **remember** it. |
| J: It's interesting that you first talk about corners and then about vertices. Can you elaborate on that a bit? For instance you're choosing not to go straight to vertices. |
| T: Yes! Because its a primary school and I want them to be in a position to explain and in most case I'll say to them your younger brother in grd 2 or grd 3 ...<br>I'd normally say to them "Just explain.. if your younger sister or younger brother in a lower grade asks what do you mean by a certain... like what is a remainder or what are vertices, what are you going to say to them? Then I'll be able to see if they do understand the concept , they can identify it with day to day life. |
| J: So you're using informal every day kind of language to get the concept and then you introduce the mathematical language |
| T:yes |
| J: So how do you decide when they're ready for the math language |
| T: You know what, there would be that evaluation from time to time and you'd see if most of them can respond to the questions that I've asked for example: If we're doing addition and I say, what is the sum of this and this. Then if they know, I would see by the response but if they're struggling with the mathematical terminology then I'd revert back to reintroduce the concept. |
| J: So sometimes you'd go from the more formal to the less formal |
| T: Yes |
| J: To the everyday |

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| T: Yes. For example last week I did angles with them and did a thorough lesson with them and last week I was doing revision with them and i saw that they were struggling so I literally took a step back and did the whole lesson again.<br>I had to literally ask them to cut strips of paper and i had pins and put the pin through and move – you know like rotate, but I was explaining more on the correct words , which one is a rotating arm, which one is a fixed arm and they had to show the direction and they had to paste that in their books be cause they were struggling just to draw them. You know the abstract. I thought they woudn't have a problem because last term they managed but you know they're kids at the end of the day. |
| J: And I noticed that your learners, I was amazed that your learners are familiar with divisor, dividend and quotient. I mean, I'm not even so...<br>I get them mixed up. Did they come to you already knowing that language? |
| T: I've been teaching them from grade 4 |
| J: So they're well trained |
| T:I was shouting at them today about their test cause I felt they could have done better in their test . I actually moved them around and everything. But I know their capabilities their strengths and weaknesses. |
| J: You seem to know them well... because the way they were using words like dividend and quotient it sounded to me that they actually knew what they were. They'd got beyond the point of just hearing the words they actually do know what you mean when you say them. I think.. |
| T: I hope so |
| J: . I mean do you think they do? |
| T: Yes they do. They may struggle with the long method of division and everything and most of them will say "Mam can we use the short method of division and everything?" but they know what a dividend is and a quotient is even if you can have it in a word sum they're still in a position to identify those words. |
| J: No I was quite impressed with that. I'm just looking if there was anything from your first lesson on 2D and 3D that I wanted to ask you about..... Ja, maybe this...<br>J: You said:<br>• T: what type of sides or what type of lines are parallel lines?<br>• L: lines that are next to each other but never meet<br>• T: lines that run next.. opposite each other but will never meet. Then you elaborated on... you were showing them which ones were parallel. Were you elaborating on this, I don't know if you can remember. |
| T: I think I was elaborating. |
| J: OK Is that something you do quite a lot? |
| T: Most of the time I would .emphasize on that so that if the other one did not understand what the question wanted or what was the answer they can always pick up cause I think you saw most of them, their minds just run out. From time to time you need to bring them back to the lesson but I do elaborate |
| J: So when you elaborate is that for the rest of the class? |
| T: For the rest of the class, yes. Basically for the rest of the class and then even for my weaker learners. |
| J: And has that got something to do with not being english speaking or not |
| T: Not really. I think its because I'm very passionate about inclusion and I think. |
| J: You want everybody to understand |
| T: Ja, its not possible that everybody will understand but I'd really like that thing, |

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| that's my ideal to see all my learners being... you know they will never be at the same level but even my weaker learners passing |
| J: And what do you think about their ability to talk maths |
| T:At present they're at different levels and my strong learners can, they're well aware of mathematical language, they can express themselves in mathematical language. The weaker learners from time to time, struggle. |
| J: So they can explain themselves, the stronger ones.and they can justify if they make a statement, they can justify why they think its right. |
| T: Yes. At times we do have lessons where they actually challenge me. But in most cases you find that quite a few... I think you know Z.... ., Prof H's son. |
| J: Yes. Is he in the class? |
| T: Yes. In the first lesson that you observed. He would go on and on challenging me cause the other day i was teaching them how to calculate the size of the circumference of a circle. What about the area of the circle and everything? It's not part of their curr in grd 6 but I had to explain it to him and most times you can see that even those that are interested they actually losing track so from time to time I'll go to him and explain "with this one you'll calculate it this way but do not expect it in grd 6, maybe in grd 7. |
| J: Ja, and then they like that.. learning what they do in grade 7 "And I'm managing!" |
| T: But that's nice –you move those who can,you're moving them forward rather than holding them back because of weaker learners.... but its very difficult to manage<br>It's either you move forward quickly with those that can grasp the concept and you forget about the others , or, you actually trying to bridge and the others tend to be bored and everything because you're trying to bridge the gap between the (inaudible) |
| J: Hmm and in a couple of lessons its OK but on a daily basis its pretty tough to manage<br>What I wrote here is "You seem to know where you're going... mathematically you seem to know - I want to get to this point this is my plan and your worksheets and handouts are aimed in that direction. To what extent do conversations with learners send you on a different track ? |
| T: With maths its... they do not derail me that much because whatever the discussions that are going to come up is going to be linked to the concept so with mathematics its not easy for them to derail me... but I'm teaching EMS and at times I find myself having to bring them back to the topic ... 'oh my mum is doing this' .... because there is more discussion than the actual working<br>In mathematics you know you've gotto do this and this and this and you can always categorise and scaffold |
| J:So you can bring the learners question into the discussion |
| T: Ja |
| J: OK so now... I want to talk to you about **repetition** because I notice that there are 2 main things that you do.. earlier on we were saying that you elaborate so sometimes you're elaborating on what a learner says and other times you repeat it in the same way as the student said it so its obviously a **strategy** that you use.. I'm not sure if you're conscious of it – often we're not conscious of our strategies but this is of great interest to me (laughs) |
| T: Yes I must say at times its just for... at times I'm unconscious of like repetition... at |

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| times i use it as an **affirmation** ... you know because at times a child will answer you and look like doubting and I've seen when you actually use the learners words , word for word, they get that sense of affirmation and they feel "you know what, I've answered the way the teacher wanted". To them it means a lot, but at times it just happens unconsciously, I'm not even aware of it. |
| J:You know if you go through the transcripts you'll see it most of the time. Cause what I say that you do, is that you repeat and then you use it almost as a springboard for the next thing you want to say |
| T: OK |
| J:I don't know if I can find an example..... I don't know if you would describe it in a different way but the word springboard comes to mind when I thought of what you say. |
| T: OK |
| J: OK heres an e.g. you were asking them about the difference between , what's same between squares and rectangles and<br>• M said " 4 right angles " and you said:<br>• T: " 4 right angles.. so what is common between the square and the rectangle, what is common?<br>• L:They both have right angles" And you said:<br>• T: "Both of them have got right angles, but what makes them different from each other?"<br>. |
| J:So its like you affirm and you use it to move on |
| T:Yes |
| J: Ja and then the other strategy you seem to use is **rephrasin**g what they've said if its not quite right |
| T: It depends... I **do not like to shut them down** You know when we grew up we always had this thing that mathematics was difficult and teachers that teach mathematics, you cannot be friendly with them . Ja, there was that attitude between the teacher and the learners. |
| J:Distance |
| T: Ja distance.. so unlike with life orientation and all these other subjects where you can engage in a discussion , I would rather say "OK alright but who has an alternative answer to that and then link the two and try to find something that is (laughs) common or correct it but in a way that doesn't shut the child down. |
| J: That strategy you didn't use while I was here |
| T: OK( laughs) |
| J: but I'm sure you've got lots of strategies up your sleeve that I didn't see but.... there was that one where you were **elaborating**. I mean most of the time you're either elaborating or repeating in the lessons that I saw.<br>Ja we've got one ... a Georgi or a Jabu... have you got a Georgi or a Jabu in the class? |
| T: No |
| J: you've got a Jabu haven't you? No? I couldn't hear the name properly.<br>You said:<br>T:OK we;re waiting for you, you're going to draw the shapes from different perspectives, what does perspective mean? |
| T:Yes |

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| J:And the learner said “from different views” and you repeated “form different views ,right bird’s eye view, you’re going to draw which part ..top..<br>So that’s springboard again. Affirming and then moving on. Well I mean you’ve gotto move on once you’ve affirmed, what else can you do?<br>I’m looking for ... there... OK... Now here, this i found interesting. You asked.<br>• ” Are you not going to get a bigger number when you multiply? This question was 994 divided by placeholder equals 14.<br>• And T said multiply 994 by 14. And you said,<br>• ” Are you not going to get a bigger number?<br>So implicit in that you’re telling them to divide. |
| T: Yes |
| J: Right? And then another learner says “divide” and then you said which is elaboration here<br>• T: “you’re supposed to divide because they’ve given you the dividend and the quotient. What are you looking for exactly. And then they say: The divisor.<br><br>What struck me about that is ... if you’ve got the dividend and the quotient, then you’re looking for the divisor cause they know there are 3 terms involved but if a learner doesn’t really understand them, I’m not sure that would really help them to understand it. They might know that they would have to use the divisor but I’m not sure that they could do it themselves. I don’t know what you think about that?<br>Umm... Do you know what I mean? That the language in that situation might be masking .... the maths. (Laughs) I wasn’t sure but thats why I marked this out. I don’t know whether that... cause what you were saying is generally you **elaborate in two ways** – one is to give them the mathematical language which you could say you were doing there by saying “ the dividend and the divisor”.... and the other is to make it more understandable OK and I think this learner just took 2 things and said multiply |
| Ja |
| J: She knows that there is multiplication involved you know, that multiplication and division are the inverse, so what I’m saying is i’m not sure whether that helps her to understand, or whether it just tells her “No you’re supposed to divide”. Cause if you’ve got these 2 then you use the 3rd one |
| T laughs |
| J: But I don’t know. I think its something to think about. Thats just something I was thinking about.<br>J: And you used the word inverse. There again you use a lot of mathematical language.. wherever you get the opportunity I think you’re consciously doing that aren’t you |
| T: At times i do it unconsciously and then they will ask “what does this mean” but in most case I would like ... for example. I would say OK what’s the opposite of addition right and then we say its an inverse |
| J: Yes I was there when you did that. And then do they start to use the word inverse? |
| T: Not all of them |
| J: But after a while? Some of them |
| T: Some of them |
| J: because that’s what my study is about |
| T: laughs. After a while some of them would start to use it |

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| J: Ja my study is about appropriation of mathematical language basically by the students – not whether they do or they don't but how you make it available to them which you do and you do it through repetition and rephrasing – or mostly rephrasing I think because in repetition you're repeating what they say. If its not the mathematical language, you still use it. I think. I'm pretty sure you do.<br>J: Let me just see if there are other things that I wanted to ask you. Oh what languages do you speak. |
| T: My home language is Xhosa . I did Zulu at school |
| J:Where did you grow up? |
| T: Soweto |
| J:And where is home |
| T: Soweto |
| J: but your grandparents home |
| T: They're from M |
| J: Oh I think you told jme that before. |
| J: So Xhosa is your first language and your learners – I think there's quite a range amongst your learners |
| T: Ja theres quite a range. Most of them are either . I must say there are those whose home language is english because maybe the father comes from a foreign country or South Africans like our Indians mostly –their home language is english and then zulu so its quite a range. |
| And Sotho speakers as well |
| T: We do have. I must say I think we've got all the official languages in one (inaudible) maybe city |
| J: And you've got Venda students too? |
| T: yes we do have |
| J: so do you think that they are disadvantaged, the ones who're not English speaking? |
| T: Umm I would say, if they started at the pre-primary or they started with us at grade R or grade 1 then they are in a position to understand the concepts but we see in most cases when the learners come and they join us in the higher classes, then , in most cases, its either, I don't know if whether I should say that our standard is a bit high or what but for the first two terms they have quite a struggle.<br>T: I had a parent who came at the beginning of the 2nd term and said "You know what, my child used to get 80% at her previous school but I'm concerned cause she got 50 something %. I said to her "Probably it's the way I teach she still needs to get used to the system that I teach." Probably she was used to the other teacher's way of teaching because changing schools at times could have a negative impact on a child |
| J: It also depends the way questions are asked.There's such a range of reasons it could be. Ja I think the school does have a high standard, you have a high standard.<br>J: So what other ways do you think learners can be helped to develop mathematical ways of talking and I'm not just thinking of the vocabulary. |
| T: yes |
| J: I'm thinking of you know what the NCS expects children to be able to do, to generalise and explain and justify and interpret and all those kinds of things. Do you think that there are other ways, and this is not a trick question, laughs, maybe if we could just think a little bit are there other ways to get them to do it ...cause I've |

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| identified repeating and rephrasing . Do you think we could find other ways to help learners be able to do that? |
| T:Maybe if we.. you know... its quite difficult but if we somehow bring a practical component to the mathematics because some of the learners are kinaesthetic, some of them are auditory, some of them are visual, but its a bit , maybe its me, but its a bit difficult to be practical with all the (inaudible) .......so if you're doing measurement with them and you take them down to the field and they actually do the measuring of the field or something... ja.. |
| J: So how would that help them to develop the mathematical ways of talking? |
| T: They would link **the practical component** with what was taught in class. Obviously you're not going to take them the first time. First lesson and you take them outside. But if you've taught them – say you've got 2 or more sessions with them , you take them outside and you give them a worksheet that's got... you know... like... the correct mathematical questions |
| J: the right questions basically |
| T:Ja |
| J: Maybe it could work both ways. I mean, if you started there and then went back into the classroom to elaborate on what they were doing ... or the other way round, you start with the questions and then the practical is an elaboration, ja I think those might both be able to work. |
| T: With fractions I normally have them cutting and everything, with 3D shapes I normally have them bringing toothpicks and jellytots and I don't know whether they're actually enjoying the jellytots or (laughs) eating the jellytots after because you know I allow them to eat them after as a treat. So I don't know whether they look forward to that... but it sort of helps for them to be in a position to identify that if I put my **jellytots** here that will be my **vertex** and then my toothpick will be my **edge** so in most cases they will still remember. |
| J: No its all interlinked and anything else that you want to raise something that I haven't asked...? |
| T: I can't think of anything |
| J: Is it OK if I come back if I have any more questions. You know when I do the analysis I'm going to say "why didn't I ask that" |
| T: I think it would be wise that you come back. You know for example the repetition and the elaboration part, I was like(laughs) not aware of that – you know something that comes up- something that happens unconsciously at times and you're just not aware that you're doing it. |
| J: But that's exactly what I was looking for in my research and I found it<br>Now I have to try and establish how useful it is as a strategy and that sort of thing<br><br>So I brought 2 articles I thought you might be interested in. Again its not to try and get you to change, I think you're a great teacher but I think these are interesting. This is about mathematical discussions, orchestrating mathematical discussions and they've got 5.... (paging through the lit review) this is just what everybody else has said and then they come up with 5 practices that you use – its quite easy to follow.....<br><br>In the literature the difficulty is when you ask a question that is what they call cognitively demanding and learners can't really understand it – what do we do? Do we make it easier? Most teachers do – they make it easier and easier and easier to the point where its not really worth asking. There's a whole lot of research about that.<br>And then I brought you something on the advantages of being bilingual – which you |

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| seem to be |
| T: yes |
| J: and thank you |
| T: thank you so much |
| J: Its been a real treat. You know once you leave  the classroom and even when you're teaching, you don't get to see how other people teach so its a treat to see what other people do. |

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