
**A study of social solidarity and the constitution of school
mathematics in five working class schools in the
Western Cape Province of South Africa**

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A minor dissertation submitted in partial fulfilment of the requirements for the award
of the degree of Masters in Education

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DECLARATION

This work has not been previously submitted in whole, or in part, for the award of any degree. It is my own work. Each significant contribution to, and quotation in, this dissertation from the work, or works, of other people has been attributed, and has been cited and referenced.

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Abstract

This study investigates how forms of social solidarity influence pedagogic practice and the manner in which they are implicated in providing information to the teacher about what it is that students have constituted as criteria for the production of legitimate text at five working-class schools in Greater Cape Town. It explores the contextual features that co-occur with social interactions in each of the five schools. It shows how each of the identified features impacts interactions of the participants during pedagogic practice as well as their importance in shaping the pedagogic communication at the classroom level. It also investigates the ways in which teachers evaluate students' acquisition of criteria for the reproduction of school mathematics during pedagogic exchanges.

Descriptions of teaching are developed in terms of the types of questions that teachers ask their students. I employ Weber's (1949) technique of constructing *ideal types* to categorise teacher questions in terms of their purposes in order to investigate how the questions that teachers ask are implicated in the structuring of pedagogic communication. I examine whether or not questions target individual students or the whole class. I also establish whether or not questions that teachers use are productive to ascertain the level of students' acquisition of criteria by looking at the type of responses students produce. The study interrogates the validity of links drawn by Dowling & Brown (2009) between Durkheim's notions of *organic* and *mechanical solidarity* and their notions of *communalising* and *individualising pedagogies*.

The results of this study suggest that the questioning strategies are implicated in the form taken by social interactions of participants during pedagogic practice. The results reveal that communalising pedagogic strategy was the most prevalent across the schools. Consequently, teachers gathered rather meagre and unreliable data about their students' acquisition of criteria for the reproduction of mathematics texts.

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Acknowledgements

I would like to pass my sincere gratitude to my supervisor Dr Zain Davis for his significant intellectual contributions to the development of this work. He devoted his time and patience for guiding me throughout the whole project. His overwhelming academic support and commitment pay a dividend of the completion of this study. Sometimes his critical comments and thought provoking questions disconcerted me, however with time they really helped to enhance my understanding, as well as putting me back on track. I consider it a great privilege to have worked under his academic guidance and supervision.

I am also grateful to Shaheeda Jaffer who never turned me down whenever I was looking for help. My special thanks to Derek Gripper, who always assisted me with the logistical issues for accessing the schools. I am also indebted to the teachers who allowed me into their classrooms as well as the principals who gave me access to the schools. I also want to thank staff members of the Schools Development Unit, who provided information which contributed immensely in this study. I am indebted to all members of the Group for the Study of Pedagogic Operatory Spaces, I have really benefited a lot from your discussions.

This study forms part of the Mathematics and Science Education Project at the University of Cape Town, funded by the Royal Netherlands Embassy. The project also contributed in funding part of my studies. Any opinions, findings and conclusions or recommendations expressed in this dissertation remain the responsibility of the author and do not necessarily reflect the views of the Royal Netherlands Embassy.

Special thanks to my wife 'Makeanetse for her contribution for typing and reading through my observation notes. I really want to show my great appreciation to her and my daughter Keanetse for their love, patience as well as their emotional support throughout my academic life. I would also like to express my special gratitude to my mother for her support when I went through hardships. I am very grateful to the rest of my family and friends for their invaluable support and their confidence in me. Finally, a deep-rooted source of inspiration throughout this study has been fond memories of my late sister.

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Abbreviations

HSRC	Human Sciences Research Council
HoA	House of Assembly
HoR	House of Representative
DET	Department of Education and Training
SES	Socioeconomic Status
DS-	Low Discursive Saturation
DS+	High Discursive Saturation
ISAs	Ideological State Apparatuses

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Chapter 1

Introduction

1.1 Motivation for the study

This study developed out of curiosity sparked by engagement with the work of Dowling & Brown (2009) relating to an observation of mathematics teaching captured in the video records of mathematics classes of secondary schools participating in a research and development project. Paul Dowling and Andrew Brown conducted a study in three South African schools of the link between pedagogy and community – the latter as constituted in schooling. In their analysis, they postulate the existence of a specific set of relationships between the forms taken by social solidarity in schools, and the ways in which pedagogy is structured in those schools. The three schools that featured in their study were distinguished by the social class membership of their students, with specific types of social solidarity thought to be correlated with specific social classes. One of the schools that they visited was populated predominantly by upper middle-class students; the second predominantly by working-class students; and the third school was a ‘hybrid’, having a mixed population of middle- and working-class students. Their study was carried out across school subjects and grades, depending on the classes they were given access to in the three schools.

Dowling & Brown (2009) report that in the school populated by upper middle-class students, the teachers interacted with individual students frequently, indexing what they termed an *individualising pedagogy* (p. 32), where students were held individually accountable for their behaviour and learning.

In the school attended mostly by working-class children, they observed that teachers tended to interact with their classes as a whole, as ‘communal subjects’, indexing what they referred to as a *communalising pedagogy*. For example, in some classes of the working-class school, the teachers would often punish the whole class when a few students had not done homework rather than single out the guilty students (p. 26).

In the third school, which served a mixed population of middle- and working-class students, they noticed that some teachers interacted with individual students, while others treated their classes as communal subjects, i.e. there were two pedagogic modalities at the school.

The notions of communalising and individualising pedagogies derive from Dowling & Brown’s (2009) appropriation of elements of Durkheim’s (1984) theory of social solidarity and the work of Bernstein (1975, 1996). Durkheim’s theory of social solidarity is often featured in the literature of the sociology of education concerned with the relation of social class to pedagogy and curriculum

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(e.g., Bernstein 1975; Atkinson, 1985; Sadovnik, 1991; Davies, 1994; Power & Whitty, 2002; Davis, 2005; Hoadley, 2005; Dowling & Brown, 2009). Many of these (including Dowling & Brown, 2009) have engaged with Durkheim's theory by drawing on Bernstein's approach. Using Durkheim's theory of social solidarity, they argued that social integration within schooling has shifted from mechanical solidarity towards organic solidarity due to the changes in the character of the education system. Bernstein (1975: 79) used this theory by focusing on the division of labour with respect to teachers, students, pedagogy and the distinctions between school subjects. However, the way in which Bernstein used Durkheim's theory is arguably problematic, because he used both mechanical and organic solidarity in a manner that does not fully accord with Durkheim's definitions of those terms (cf. Davis 2005: 63). This will be discussed further in Chapter Three.

The conclusions that Dowling & Brown (2009) derive from their study are, nevertheless, very interesting because they provide a general proposition about the social organisation in various schools in the South African context, both in relation to the social class base of the student population, and in terms of its (apparent) effects on the structuring of pedagogic communication. Their study used a small series of three cases and did not focus on a single school subject. The data they generated, however, does not clearly demonstrate that the general propositions they derive about the relationship between social solidarity and pedagogy are necessarily valid in the context of school mathematics lessons, or, for that matter, any other school subject. That said, their notions of individualising and communalising pedagogies do seem to have some reasonable purchase on pedagogic practice. Despite this, for the reasons outlined below, those notions should, for the moment, be dislocated from their relation to social class for the purposes of generating data, and then reconsidered in relation to social class once the data has been produced and analysed.

My study is a contribution to the development of methodological resources for the description and analysis of mathematics pedagogy emerging from research in five Western Cape schools. The general problematic within which the study is located is that of the constitution of school mathematics in pedagogic situations. However, my study does not directly address issues relating to the constitution of mathematics. This study specifically examines the manner in which individual teachers interacted with students in a series of mathematics lessons. It is useful to do this because interactions of the participants caught up in pedagogic practice index structuring effects on pedagogic communication. For Brown & Dowling (2009) those effects derive from the social class memberships of the pedagogic agents. The present focus is on the transmission and acquisition of criteria for the production of texts in mathematics lessons because it is students' knowledge and use of appropriate criteria that is central to their abilities to perform successfully when doing school mathematics. More specifically, the ways in which teachers evaluate students' acquisition of criteria for the reproduction of school mathematics during pedagogic exchanges are investigated. The contextual

features that coincide with the social interactions in each of the five schools are also explored. Also shown is how each one of the features impacts on the interactions of the participants during pedagogic practice, as well as their importance in shaping the pedagogic communication at the classroom level. Most importantly, this study investigates aspects of teachers' strategies for evaluating the status of students' acquisition of the criteria for the reproduction of school mathematics.

In this study descriptions of lessons will be developed in terms of the types of questions that teachers ask. The questions that teachers ask will be investigated to determine how they are implicated in the structuring of pedagogic communication and it will be established, by looking at the type of responses students produce, whether questions that teachers use are productive in ascertaining the level of students' acquisition of criteria.

1.2 The research question and related matters

This study addresses the general question which is expressed as follows:

How do forms of social solidarity relate to pedagogic practice and how are they implicated in the constitution of school mathematics?

This question can be approached with the help of the following questions:

- (1) What are the ways in which the pedagogic communication with specific reference to teachers' questions and students' responses replicate the social organisation?
- (2) What are the implications of social interactions for student access to recognition and realisation rules for the reproduction of mathematics texts?

1.3 An initial description of the research sample

The data used in this study emerge from records of the teaching of mathematics in five working-class schools in Western Cape. The five high schools are situated in the greater Cape Town area and the students in the schools are so-called 'African' and 'coloured', from working-class families. The information in the archive was collected in 2009 in the form of video records and transcripts of mathematics lessons and the observation notes of Grades 8, 9 and 10 lessons across the five schools. For each grade, three consecutive lessons of a class were observed and video recorded, except for two classes where two lessons were observed (i.e. one double lesson and a single lesson). In total, therefore, there are 43 videos and transcripts of lessons across the five schools. Two cameras were used to capture information, one focused on the teacher and the other on the activity of the learners. The video records were transcribed and, where necessary, translated from isiXhosa and Afrikaans into English.

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To supplement this information, this researcher spent at least one day in each of the five schools and observed Grades 8, 9 and 10 lessons. The pedagogic relations in terms of teacher-student interactions and student-student interactions were of prime interest in respect of these observations. In addition, seven researchers who observed mathematics lessons in the five schools were interviewed.

1.4 A map of the dissertation

A selection of pertinent research literature is reviewed in Chapter Two. This consists mainly of studies in the sociology of education and mathematics education. The chapter is intended to locate the empirical focus of this study. The literature survey focuses on three interconnected factors that are assumed to have an impact on the evaluation of the acquisition of mathematics criteria in pedagogic situations. These factors are, namely, (1) differences in the socialisation of students from families that differ in social class status; (2) the differential distribution of knowledge in schools along the lines of social class; and (3) the kind of interactions between teachers and students manifested differ in terms of the social class background of the students.

Chapter Three outlines the theory that informs this study. The selection of resources has been made on the basis of an assessment of the importance of the work in addressing the question. The purpose of the chapter is to generate a set of propositions from which an analytical framework can be derived. The chief theoretical resources that are drawn on emerge from the following: Durkheim's theory of social solidarity, Bernstein's theory of the pedagogic device and related work, and Dowling & Brown's (2009) discussion of the relationship between pedagogy and community in three South African schools.

The primary focus of Chapter Four is the development of the descriptive and analytic resources employed in the production and interpretation of data. The chapter consists of two main components, the first of which focuses on the aspects of social interactions manifested in the schools while the second gives attention to the evaluation by basically examining the types of questions that teachers ask in the lessons. In the first component, the framework for data production is set out: its central object comprises features that shape the interactions of the participants during the lessons. The second part of that chapter comprises a framework employed in the second part of data analysis, which is displayed in Chapter 6. The data is described in terms of the types of questions that individual teachers ask per lesson and the kinds of responses that students offer. Chapters Five and Six present the production and analysis of data following the framework discussed in Chapter Four. The concluding remarks are presented in Chapter Seven.

Chapter 2

Literature survey on social class and pedagogy

This study investigates how forms of social solidarity influence the structuring of pedagogic communication. It examines how teachers use their questioning of students to regulate pedagogic practice during lessons. It also scrutinises the manner in which teachers are informed about the level of students' acquisition of mathematics criteria and act on that information.

This chapter delineates the empirical focus of the study in relation to relevant research literature in the sociology of education (and mathematics education in particular). The central focus of the literature survey is on three interrelated factors that are believed to have an effect on the evaluation of the acquisition of mathematics criteria in pedagogic situations. These factors are, namely, (1) the different socialisation of students from families that differ in social class status; (2) the differential distribution of knowledge in schools along the lines of social class; and (3) the kind of interactions between teachers and students manifested in the schools or classrooms that differ in terms of the social class basis of the students. Literature that discusses how the social class basis of the students may affect their interactions with teachers and their fellow students in the classroom is included. Teacher-students interactions, in turn, could also impact on how teachers gather information about how their students acquired criteria for the reproduction of pedagogic texts.

In the first instance, then, literature which focuses on the two positions on social reproduction which appear to be dominant in the current debates on the sociology of education will be reviewed. Secondly, studies in mathematics education which focus on the relationship between social class background and pedagogy in the classroom will be explored. Finally, arguments made in studies which highlight the impact of certain kinds of interactions between pedagogic subjects, and the implications of such interactions on the structuring of pedagogic communication will also be examined.

2.1 Social reproduction

Various studies in the sociology of education revealed that there is a wide achievement gap between working-class and middle-class children in the standard examinations, particularly in mathematics (see for example Simkins & Paterson, 2005; Fleisch, 2008; Carnoy & Chisholm, 2008). Numerous research studies have attempted to identify the possible contributing factors to this perennial problem. Debate has been robust, especially between the social reproduction theorists, on what actually perpetuates inequality. On the one hand, there are those who argue that home background socialisation has an immense influence on the academic success of children in schools (see Evans et. al, 2010; Pimlott-Wilson, 2011). On the other hand, there are those who argue that schooling should be held accountable for differentially distributing knowledge to the students in terms of social class (for example Bowles & Gintis, 1976; Apple, 1980; Alexander, 2001; Luke, 2010). Both arguments that emanate from these differing perspectives are of interest in this study. As the study is on the pedagogic practice at classroom level, proponents of the latter position will be focused on more.

The arguments made in these two differing approaches will be critically evaluated. The arguments that recognise home background as the main contributing factor of the students' academic success in schooling will be examined in the first instance. A specific focus will be on language use and its orientation to meanings. Also to be explored will be the arguments that focus on how schooling differentially distributes knowledge to students in terms of their social class background.

2.1.1 Students' home background

Language-use and orientation to meanings

Bernstein (1964) argues that different social structures may generate what he referred to as different 'speech systems' or 'linguistic codes'. According to Bernstein, linguistic codes entail specific principles of choice for the individual. He also indicated that these principles regulate the selections one makes from a range of options represented by a given language (Bernstein 1964: 56). In explaining this issue further, he states that

As the child learns his speech or [...] specific codes which regulate his verbal acts, he learns the requirements of his social structure. The social structure becomes the substratum of his experience essentially through linguistic process. The identity of this

structure [...] is transmitted to the child through the implications of the linguistic code which the social structure generates [...]. [E]very time the child speaks or listens, the social of which he is part is reinforced and his social identity is constrained [...] Underlying the general pattern of the child's speech are critical sets of choices, in-built preferences for some alternatives rather than others, planning processes which develop and are stabilised through time-coding principles through which orientation is given to social, intellectual and emotional referents. Children who have access to different speech systems [...] by virtue of their position in class structure, may adopt quite different intellectual and social procedures (p. 56-57).

Apparently, this may also suggest that parents coming from different social class contexts introduce their children, at an early age, to forms of language-use in different ways. Bernstein (1971: 28) argues that children in the middle-class families become 'sensitive to a form of language-use which is relatively complex and which in turn acts as a dynamic framework upon [their] perception of objects'. He terms this mode of language-use formal. He argues that access to formal language determines the way an individual makes relationships to objects and it also enables flexible manipulation of words. He also indicates that this kind of orientation allows many interpretations or meanings to be given to any one object (p. 29). This mode of language-use promotes what Bernstein referred to as context-independent meanings. The implications relating this type of orientation to language-use will be discussed later on with the support of evidence from empirical studies which focused on a similar issue.

In working-class families children learn public language¹. According to Bernstein, the nature of this type of language tends to limit verbal communication or expression of feeling (p. 32-33). This implies that public language restricts an individual when trying to express his or her views about situations. For instance, if one might be required to express an opinion on certain aspects of an object, the insufficient vocabulary would hamper the verbal response, resulting in a misrepresentation of what one intended to express, or the views will definitely not register as meaningful cues. In addition, this form of language-use may compel an individual often to make reference to contextual or tangible resources as a way of expressing one's point of view (p. 33). Bernstein mentions that the

¹ Bernstein (1971: 28) describes public language as a 'language which contains a high proportion of short commands, simple statements and questions where symbolism is descriptive, tangible, concrete, visual and of low order of generality, where emphasis is on the emotive rather than the logical implications'.

[e]xpressive order of this language has no reference other than itself. Through expressive order [...] the child in turn learns to respond to immediate perceptions and does not learn a language other than public language in his class environment. The stress on the present in the means of communication precludes the understanding of the meaningfulness of a time continuum other than of a limited order. Necessarily the child lives in the [current] experience of his world, in which the time span of anticipation or expectancy is very brief (p. 33).

This quotation may insinuate that public language enhances what Bernstein called context-dependent meanings. Some of the empirical studies which investigate a similar issue produced the same results. For example, Henderson (1973) reports that middle-class mothers communicated differently with their children. He indicates that when defining words for their children they were more explicit and they used a higher level of generality and abstraction, unlike their working-class counterparts (Henderson, 1973: 66-67). In agreement, Painter (1999: 66) argues that in families of higher socioeconomic status, parent-child interaction patterns in communication prepare a child 'from earliest years to sensitise the kinds of meanings relevant for later school learning – for dealing with educational knowledge'. She does not, however, provide evidence for the working-class context, as her study was conducted in her own family.

Implications of language-use on the schooling

The forms of language-use discussed above have consequences in the formal learning of schooling. These implications will be described by looking at two angles, namely orientation to meanings and social relations.

(1) Orientation to meanings.

It could be anticipated that children from families of different social class environments would not confront similar challenges when entering school. This is because middle-class children have an advantage with respect to their ability in language-use, which is, arguably, congruent to formal language used in the school. According to Bernstein (1971: 29), schools are institutions where every item in the present is linked to a distant future. Hence context-independent meanings that middle-class children have access to would allow them to cope better with the school practices. On the other hand, one would assume that working-class children are

predisposed to encounter some difficulties related to the basic demands of the school that are associated with language-use, because they have exposure only to public language. This was evident from some empirical studies which investigated the social class reproduction through children's differences in orientation to meaning (see Holland, 1981; Neves & Morais, 2005; Hoadley, 2005).

Holland (1981) undertook a study in which she asked learners to classify pictures of food items. She found that middle-class children tended to categorise pictures in terms of their general properties, whereas working-class children tended to categorise pictures according to their everyday experiences (p. 16). She further indicates that when children were asked to regroup the food items, the working-class children retained the previous principle for organising food items by just changing the contents of the specific groups made. Conversely, middle class children changed the principle for arranging the same materials in terms of a different meaning system (p. 14). She then concluded that 'class affects the form and content of education and the form and content of family relations, and does so in such a way that the two aspects are inter-dependent' (p. 16).

(2) Social relations

In considering how language-use may promote or destroy the social relationships between students and teachers at school, Bernstein states that the

middle-class child is capable of manipulating the two languages – the language between social equals (peer groups), which approximates to a public language, and a formal language which permits sensitivity to role and status. This leads to appropriateness of behaviour in a wide range of social circumstances. Thus, the social structure of the school, the meanings and ends of education, creates the framework which the [middle-class child] is able to accept and, respond to and exploit (1971: 33).

Conversely, Bernstein argues that there is a likelihood that working-class children, who only have public language at their disposal, could sometimes use it in situations that are inappropriate. He further states that

[T]he expressive behaviour and immediacy of response which accompany the use of this language may again be wrongly interpreted by the teacher. This may well lead to a situation where a pupil and teacher disvalue each other's world and communication

becomes a means of asserting differences. Fundamentally, it may lead to a breakdown of communications between teacher and child [...]. If the teacher is conscious of a deficiency of his own status, this may exacerbate the existing difficulty of communication. The fact that the working-class child attaches significance to an aspect of language different from that required by the learning situation is responsible for his resistance to extensions of vocabulary, manipulation of words, and the construction of ordered sentences. The attempt to substitute a different use of language and to change the order of communication creates critical problems for the working-class child as it is an attempt to change his basic system of perception, fundamentally the very means by which he has been socialised (1971: 34).

The idea that working-class children are predisposed to relate to the world in ways different from middle-class children, because they are socialised in different ways will be explored further, with the assistance of evidence from some ethnographic studies, in the next section. It is essential, at this juncture, to look at the arguments that blame schools for being institutions that reproduce social class differences among the children.

2.1.2 Social class reproduction through schooling

The researchers interested in the issue of schooling as a regulating body of the future occupations of students, follow quite different approaches which Willis (1981) articulates. These ideas will be merged here, and considered as social class reproduction through schooling. Examined first will be a perspective which argues that schools are discriminatory when distributing knowledge to students. Thereafter another perspective which shows how students from different social class backgrounds act in response to the school environment will be interrogated.

Discriminatory distribution of knowledge at school

Some of the works that focus on the differential distribution of knowledge in schools include Bowles & Gintis, 1976; Apple, 1980; Apple 1982; Nash, 1990; Bourdieu & Passeron, 1992; Alexander, 2001; Bowles & Gintis, 2002; and Luke, 2010. Alexander's (2001) work focuses on primary schools across different cultures. His work revealed that UK schools attended by students from different social class background were likely to offer different educational quality. The lowest in the hierarchy were 'parish and elementary schools' (Alexander, 2001: 151).

He quotes a controversial statement made by one educational reformer which states that '[f]or each class of society there is an appropriate education', and the elementary schools [are] definitely for 'the people' rather than the 'upper classes' or 'the middle classes' (p. 151-152). According to him, this statement implies that 'the education that mattered, for the people that mattered, took place elsewhere'. He explains how the education system operates, and states that

schooling and curriculum select from a society's spectrum of values and ideas and this selection informs and pervades curriculum, teaching and assessment. At the same time those in receipt of this selection are themselves already located somewhere in relation to it (inside or outside) as members of one or another cultural group or segment, defined perhaps by gender, class, race or ethnicity. And the encounter takes place in an institutional setting – a school – which, as a micro-culture both conveys its messages and filters and perhaps subtly modifies those coming in from outside. Thus schools and classrooms are both cultural channels or cultural interfaces and micro-cultures in their own right (p. 164).

Bowles & Gintis (1976) appear to be curious about how schooling functions. Even though they acknowledge the importance of the contribution of education to an individual's economic opportunities, what piqued their curiosity the most was why the overall effect of family background on education attainment had remained substantially constant over the years. They note that equal education attainment has not always guaranteed equalisation in income among individuals (p. 8). As a result, they argue, therefore, that there could be something in schooling which perpetuates a difference in educational success on the basis of social class. They claim that the structure of the education system, which arguably determines the prevailing degrees of economic inequality, is defined primarily by the market, property and power relationships indexed in the capitalist system (p. 11). In elaborating this point further, they state that

[schooling] is an institution which serves to perpetuate the social relationship of economic life through which these patterns are set, by facilitating a smooth integration of the youth into the labour force. [...] Schools [also] foster legitimate inequality through the ostensibly meritocratic manner by which they reward and promote students, and allocate them to distinct positions in the occupational hierarchy. They create and reinforce patterns of social class [...] identification among students which allow them to relate "properly" to their eventual standing in the hierarchy of authority and status in the

production process. Schools foster types of personal development compatible with the relationship of dominance and subordination in the economic sphere, and finally, schools create surplus of skilled labour sufficiently extensive to render effective the prime weapon of the employer in disciplining labour – the power to hire and fire (p. 11).

Althusser (1971) reiterates similar arguments using his theory of Ideological State Apparatuses² (ISAs). He indicates that education is one of the ISAs which play a major role in social class reproduction. He explicitly states that

[school] takes children from every class at infant-school age [–] the years in which the child is most ‘vulnerable’, squeezed between the Family State Apparatus and the Educational State Apparatus, it drums into them, whether it uses new or old methods, a certain amount of ‘know-how’ wrapped in the ruling ideology [in the form of school subjects] or simply the ruling ideology in its pure state (ethics, civic instruction [and] philosophy). Somewhere around the age of sixteen, a huge mass of children are ejected ‘into production’: these are the workers or small peasants. Another portion of scholastically adapted youth carries on [pursuing different professions] (p. 147).

Additionally, Althusser argues that each of those different categories of people is equipped with skills which only suit the specific role it has to fulfil in class society (p.147). This suggests that working-class children are provided only with limited knowledge that would make them submissive to their employers, unlike middle-class children who stand a better chance of occupying professional jobs. Bowles & Gintis, however, (1976: 12) mention that hierarchical relations at a school which was authoritarian would not always produce docile workers, but it could also produce misfits and rebels. This will be further explained in the next subsection which demonstrates how students from different socioeconomic backgrounds react to the school environment.

Influence of students’ social class background in the school environment

It appears from evidence in some ethnographic case studies that social organisation within schools differs in terms of the social class basis of students. Willis’ (1977) study is one of the earliest ethnographies to investigate how the socialisation of students might influence their future

² Althusser (1971) defines ‘Ideological State Apparatuses [as] a certain number of realities which present themselves to the immediate observer in the form of distinct and specialized institutions’.

job occupations. He uses young working-class males as his case study, and argues that working-class students' counter-school culture forced them to be resistant to both school activities and its authorities (p. 11-22). As a result they left school early to occupy positions in the manual labour market. Their middle-class counterparts progressed in their studies, thereby giving them opportunities to get elite jobs. According to Willis (1977: 145) these circumstances reproduced a division of labour based on social class.

Similar outcomes (as far as counter-school culture is concerned) were discovered in recent ethnographies conducted in South African schools (see Dawson, 2007; McKinney, 2010). McKinney's (2010) study was conducted in the girls' school that was attended mostly by working-class students but that previously served middle-class students. She provides an analysis of 'a selection of telling moments in which learners draw on a wide range of semiotic resources not usually valued in the official discourses and practices of the school in order to perform hybrid identities' (p. 192). The findings of her study revealed that the students in that school were representative of township youth culture (p. 204). For example, students in one Grade 10 class organised themselves in informal groups or friendship 'gangs'.

She indicates that the students often communicated in township slang, which was counter to the official discourse of schooling (McKinney, 2010: 203-204). It is evident that students were not able to separate their township life from their school environment, thereby resulting in a blend of hybrid identities. This suggests that the culture resistant to official school discourse might have a negative impact on the ability of students to produce the privileged texts, thus automatically affecting their academic success. It is obvious that such resistance to school practices might put students' academic careers in jeopardy: they might end up being expelled or leave school voluntarily. Of course one would not expect to find such behaviour from every student in the entire school, which prompts investigation of other factors that may act as impediments for working-class students to attain academic qualifications.

The section that follows explores the relationship between social class and pedagogy by focusing on the mathematics education perspective.

2.2 Relationship between social class and pedagogy in the mathematics classrooms

In the previous section it was argued that schooling plays a major role in reproducing differences in social class. This section will examine how students and teachers interact in classrooms of different social class contexts. Teaching approaches that are used in schools and their implication on the acquisition of mathematics criteria will be explored; and arguments concerning the role of teaching resources that target learners of different social class backgrounds, which appear to promote class differences, will be examined.

Teacher-student interaction

Atweh, Bleicher & Cooper (1998) conducted a study in two schools attended by students of a different gender and from a different socioeconomic background. One was a girls' school and working-class, the other was a boys' school and middle-class. In their study they sought to explore the following questions, namely, (1) how teachers' perceptions of their students' abilities and needs are affected by the gender and socioeconomic backgrounds of the students; and (2) how teachers' perceptions of their students' abilities and needs contribute to the construction of different classroom discourses (p. 65).

They identified some commonalities in the way the teachers conducted the class, including the mode of instruction used in respect of the whole class. Teachers in each of the schools conducted lessons largely by engaging in a series of question-answer dialogues with students. Following a closer inspection of classroom interactions, however, the researchers noticed some differences in the ways in which the curriculum was covered. The differences were generally consistent with the teachers' beliefs about their students' abilities and needs (p. 68-70). These authors report that, in an interview, the teacher at the middle-class school perceived his students as having a high ability in mathematics and said '[t]hese kids are going to be mathematicians in the sense that they are going to be able to construct models and draw inferences from them whether it be in business or in the scientific field. That is basically where we have to head with our mathematicians' (p. 68). The teacher conducted lessons in a way that gave an impression of contentious debate between students and teacher. Researchers emphasise that during the lesson students did not hesitate to complain, exclaiming 'I do not understand this!' It was reasonable to assume that the students were keen to understand mathematics concepts during the lessons.

The teacher in the working-class school had different perceptions about his students. He was quoted as saying, 'The class I've got here are more or less the ordinary, middle of the road'. The teacher mentioned, furthermore, that his students had little interest in mathematics and that they often said 'I'm never going to need mathematics in the future because all I want to do is selling or be a check-out girl'. Moreover, according to researchers, the teacher did not see the relevance of some topics in mathematics, particularly linear functions, presumably because they were not useful for the students' anticipated future roles in the workforce. Here again one could surmise that the teacher was not prepared to teach mathematics in ways that would instil an understanding of concepts in the students. The consequences of this will be discussed later in this section.

It can thus be seen that the teacher's perceptions of his students affected the way he conducted the lesson. The researchers realised that the teacher had a different way of interacting with his students, compared with the teacher in the middle-class school. They indicate that the teacher's interaction with the students was, apparently, too formal (p. 74). Further, when assessing the students' acquisition of the taught content the teacher used questions that required short answers (Atweh et al.: 78). They further pointed out that the teacher evaluated the answer as correct by repeating a student's response in different words. The researchers thus argue that the strategy was used with the aim of evaluating and rewarding the student's response. Additionally, that strategy was also used for rebroadcasting the information to the whole class in a manner meant to emphasise it (p. 78).

This implies that students' social class and gender in this particular case have a huge impact on how teachers interact with their students. Additionally, the social class of their students affects the teachers' pedagogic style and influences them to prioritise certain strategies for teaching mathematics, as will be argued in the subsection that follows.

Comparison of teaching approaches

In this subsection different teaching techniques used in the schools of similar socioeconomic status will be compared. Additionally, the reasons provided about the effectiveness of each teaching technique in transmitting mathematics content to the students will be examined. After that, the teaching strategies that are used in schools that differ in social economic status will be

compared. Finally, a certain teaching strategy used by a teacher in a school which caters for students from different social class background will be scrutinised.

(1) Schools of similar socioeconomic status

In a number of her works, Boaler (1993; 1997; 1999; 2000; 2002) describes a three-year case study conducted in two schools attended by students coming from working-class families. In both of these environments, teachers followed different approaches for teaching mathematics. Boaler monitored the impact of the students' contrasting mathematical environments on the beliefs and understandings that students developed and the effectiveness of these in different situations, including the national school leaving examination as well as more applied and realistic tasks (Boaler, 1997: 2).

The teachers in the two schools taught mathematics in totally different ways. In one school traditional demonstration and practice methods of teaching mathematics were used. Boaler (1999: 260) acknowledges that traditional methods encourage students to develop mathematical beliefs and practices that are effective in the mathematics classroom. She contends, however, that those skills do not help students in solving problems that give reference to everyday practices. The other school used the 'project-based' approach of teaching. Boaler argues that this approach helps students to develop skills that are more consistent with the demands of both the classroom and the 'real world'. She indicates that the students who were taught by that method performed better in examinations than those who were taught with traditional methods thereby supporting the argument that the 'project-based' approach is more effective. She also points out that, in respect of the questions that required the application of mathematics to real life, the scores of the majority of learners in that school were higher than the national average (Boaler, 1999: 274).

(2) Schools with different socioeconomic status

During the course of a full school year Anyon (1980) observed five elementary schools in which the teaching and learning of mathematics differed in terms of the social class of the students in the schools. She reports that, in the working-class schools, the teaching of mathematics knowledge was always restricted to the procedures to be followed. This suggests that students had a limited choice of methods that might be useful for solving mathematics problems. In addition, she states that teachers rarely explained why the work was being assigned, and also how it connected to the previous assignments. Apart from that, the teacher never explained a

particular concept represented by the procedures he performed, nor gave the work coherence and, perhaps, meaning (Anyon, 1980: 73). The researcher, moreover, reports that available textbooks were hardly used, and that the teachers often prepared their own notes or put examples on the board. Anyon further indicates that the students' work was often evaluated not on the basis of whether it was right or wrong but according to whether the children followed the right steps.

Anyon argues that in the middle-class schools teachers were developing students' 'analytical intellectual powers'. She makes it clear that the children were frequently 'asked to reason through a problem, to produce intellectual products that are both logically sound and of top academic quality' (p. 10). It appears that in the middle-class schools, the most important thing was to equip students with skills that would help them understand and 'to conceptualise rules by which elements may fit together in systems and then to apply these rules in solving a problem'. Anyon (1981: 25) indicates that students were taught various methods for solving mathematics problems.

Atweh & Cooper (1995) conducted classroom observations in mathematics classes at two girls' schools with different socioeconomic backgrounds. Their aim was to investigate differences in the construction of the content of mathematics and the construction of the learners, in terms of their needs and abilities, in both classes. They indicate that, in the middle-class context, mathematics was constructed as a combination of a collection of strategies for solving tasks and a system of generalisations and justifications. They also mention that the teaching approach of mathematics was, broadly speaking, more constructivist: students developed their own knowledge through social interaction with a community of learners (p. 303). Besides that, they noticed that the teacher's interactions with her students displayed a great concern for learning with understanding mathematics concepts. The researchers deduce this from the evidence shown in the teacher's explanations which were often clear and carefully developed. The researchers conclude, therefore, that in that class the teacher developed a balance between the teacher roles of guide, director, and orchestrator of classroom learning and the student role of active developer of their own knowledge (p. 305).

In the working-class context they found that the learning of mathematics was constructed inductively. They also describe how the teacher often introduced concepts by using the implicit rules that could be referred to as context-dependent. For example, when showing the difference

between an expression and an equation, the teacher explained that ‘an expression does not have an answer, an equation has an equal sign in it (writes $2x + 5 = 10$) [and something on] the right hand side equals something on the left [hand side], where an expression is something like this (writes $3x + 7$)’.

They also argue that the teacher invited students to ask her questions if they had any problems, but they often did not utilise that opportunity. Even where the teacher’s explanation was unsatisfactory, researchers claim that the students seldom challenged their teacher to give further clarification, they just continued working blindly. Nonetheless, the students would sometimes complain and ask a teacher to slow down or to repeat the explanation. Besides that, the teacher often asked students, ‘are you alright?’ and the students would chorus ‘Yeeessss’. The researchers point out that the teacher appeared to realise the game-like nature of the interaction and would add sarcastically ‘I am sure’ or ‘I doubt that very much’ and continue on to the next part of the lesson (p. 304).

Atweh et al. (1998) cited earlier, also comment on the teaching approaches used by teachers in different social class contexts. The researchers found that the teacher in the middle-class school introduced mathematical ideas formally by presenting rigorous definitions of the concepts. They specifically indicate that the terminology used by the teacher was characterised by formality and rigor and was typically found in mathematics texts. In addition, the researchers point out that the teacher presented these definitions both orally and in writing on the blackboard. Further on in the lesson they realised that the teacher gave examples of functions and non-functions, illustrating how the formal definition could be used to differentiate between the two types of relations. They also noticed that when the students were experiencing some difficulties the teacher would draw a function machine to illustrate the function, yet he always insisted on using mathematical language (p. 70). The main objective of the teacher in that school was to nurture the students’ independence in self-assessment and their involvement in controlling their learning. The teacher considered the students’ independence to be a useful skill which they would require to meet any of their future aspirations in higher education. The students were, therefore, challenged to engage in checking their own progress all the time (p. 73).

In the working-class context, a teacher hardly ever mentioned the definitions and the proper terminology of mathematics to his students. Although he did mention the formal terms used in the book such as domain and co-domain, he was less concerned with developing their meanings

to students. His primary focus was to develop their intuitive and algorithmic usage. According to the researchers this approach was reflected later in the lesson, when the teacher gave many examples of functions and non-functions and also helped students to generalise patterns from these examples. He inductively used the patterns to introduce the definition of a function which of course meant that it was a false definition of a function that was conveyed to the students. Of course an intuitive understanding of definitions had to be abstracted from examples, and the use of the ‘formal dialect’ was de-emphasised (p. 73). The students were largely dependent on the information provided by the teacher. The researchers also point out that the teacher always corrected the mistakes that students made or helped those who encountered difficulties by discussion at the blackboard. In addition, he provided further examples and repeated the rules he had developed earlier.

(3) School serving children of different social class backgrounds

Lubienski’s work (2000; 2002; 2004) focuses on examining the relationship between the students’ socioeconomic status (SES) and their experiences with what she called ‘reform-minded’ pedagogy. In her analyses she shows that the ‘higher-SES’ students benefited more from the discussion-oriented pedagogy. She points out that those students were confident to express and defend their own ideas. In addition, she found that the way in which those students expressed their ideas was often not focused on specific contexts but was aimed at discussions of generalisable mathematical principles. Moreover, the ‘higher-SES’ students generally viewed the discussions as a helpful forum for exchanging ideas (Lubienski, 2000: 377, 398). Lubienski further indicates that more ‘lower-SES’ students confessed that the conflicting ideas brought up in discussion tended to be confusing, and for this reason they preferred more teacher-driven directives. ‘Lower-SES’ students also focused more on giving correct answers to specific, contextualised problems (p. 377).

Veel (2006: 194) argues that in the mathematics classroom, language could be used to construct knowledge and regulate access to that knowledge in ways totally different from those used in other pedagogical contexts. Drawing from the transcripts that reflect on the pedagogic communication contained in the lessons, he indicates that the mathematics language used by the teacher and the textbooks has high *lexical density*³ compared with student-to-student

³ Veel (2006: 212) defines *lexical density* as ‘the average number of content words, or lexical items, per clause’.

communication. He points out that students could improve their use of mathematics terminology if they were given greater opportunity to communicate among themselves, especially when solving mathematics problems. One of the claims that he makes is that sociolinguistics can contribute to mathematics education by

[Providing a] clear direction for language-based intervention in mathematics; a clear but not atomistic focus for language-based activities and clear criteria for effective language use which can be shared by teachers and student. [In addition], a detailed analysis and critique of current linguistic practices in mathematics education, especially in teacher language, interaction patterns, written resources and public examinations [could be achieved by employing socio-linguistics and sociological models] (p. 214).

Veel argues that mathematics resources use a highly technical language which could not be easily accessed by students. However, low lexical density in mathematics resources such as textbooks does not necessarily imply that students would acquire mathematics criteria without any difficulty. In his various works Dowling (1995; 1998; 2009) argues that textbooks that draw on everyday context (i.e. those that induce low lexical density) deny students access to authentic mathematics. This will be discussed in detail in the following subsection.

Reproduction of social class through teaching resources

Dowling (1995) uses the idea of social class when analysing mathematics textbooks. He argues that the pedagogic relations within schools may be differentiated according to ‘ability’, recognised in terms of social class (p. 14). He states that distribution of textbooks targeting different categories of students could affect mathematical practices in schools (p. 6-8). According to Dowling, textbooks that distribute high discursive saturation⁴ (DS+) esoteric domain practices are targeted at ‘high ability’/middle-class students. He states that ‘higher ability’ students would then have access to resources which might help them to acquire a high degree of context-independent knowledge, because meanings/concepts are effectively explained. On the other hand, he argues that ‘low discursive saturation⁵ (DS-) public domain practices’ are

⁴ “The esoteric domains of the various disciplines must be described as high discursive saturation which are, therefore, capable of generating utterances the meanings of which are, to a substantial extent, independent of the immediate context of their production” (Dowling 1995: 11).

⁵ ‘Certain forms of practice described as exhibiting low discursive saturation — regulate their esoteric domains via context-dependency’ (Dowling 1995: 16).

targeted at ‘low ability’/working-class students. The textbooks targeting the ‘low ability’ students presents mathematics as entirely dedicated to the preference of everyday practices at the expense of the school code (Dowling, 1995: 4). Even though Dowling’s assumption has no supporting data, one can argue that the kind of educational resources made available for working-class students would negatively affect their acquisition of authentic school mathematics. Hence, it will not come as a surprise if the working-class students underperform in the standard examination.

The implications of the above assumption are evident in the studies conducted by Cooper & Dunne (1998) and Cooper & Harries (2005) on test items that draw on ‘realistic’ or everyday context. Cooper & Harries’ (2005) study of students’ performance on standard test questions set in ‘realistic’ contexts demonstrated that working-class students performed far worse than middle-class students. This, according to Cooper & Dunne (1998: 140), could be explained by considering social class differences in the interpretation of the demands of ‘realistic’ questions, with working-class children drawing ‘inappropriately’ on their everyday knowledge when responding to realistic items. One would assume that middle-class students performed relatively well in ‘realistic’ items because they were able to interpret questions across different contexts.

This discussion left the following questions unanswered: (1) how could the distribution of the textbooks to working-class children bring significant change in the manner in which individual teachers conduct their classes?; and (2) would these children really use those textbooks effectively? In attempting to answer these questions one could argue that even if the students were to get access to the high quality textbooks, what still remains unresolved is the manner in which teachers help students to acquire the knowledge displayed in those textbooks. On top of that, teachers should be able to employ appropriate approaches for measuring the level of students’ acquisition of that knowledge. This suggests that a major problem lies in the structuring of pedagogic communication, an issue that is addressed in next section.

2.3 Relationship between social interactions and pedagogic communication

Dowling & Brown (2009) present a way of looking at the pedagogic practice in terms of social solidarity of the pedagogical subjects. They found that, in the working-class school, teachers tended to interact with their classes as communal subjects, indexing what they referred to as a *communalising pedagogy* (p. 26). In the upper middle-class school the teachers interacted with

individual students frequently, resulting in what the researchers termed an *individualising pedagogy* (p. 32). In the school catering for an amalgam of working-class and middle-class students, both communalising and individualising pedagogies were identified.

The conclusions derived from their study provide a general overview of the social organisation in various schools in the South African context, in relation to the social class base of the student population, and in terms of its effects on the structuring of pedagogic communication. Jaffer (2009) and Mackay (2010) used the same construct.

Jaffer (2009: 54) argues that the social organisation of one lesson of a school attended by working class students was structured along the lines of *mechanical solidarity*. The effect of that form of social organisation could be to produce sameness rather than differences. The teacher tended to direct questions at the whole class and, in return, the students answered in chorus. As expected, the teacher in a school populated by upper middle-class students used a strongly individualising pedagogy. The teacher asked questions of individual students and also asked them to explain how they obtained answers to particular problems (p. 53). Jaffer refers to the kind of communication which considers the differences of individuals as exhibiting *organic solidarity*. Mackay (2010: 297) argues that this strong communalising in a pedagogic context could possibly have negative implications for the learners' performance in class exercises, tests and examinations.

Communalising pedagogy is not unrelated to the common phenomenon of chorused, or unison, responses of South African students in mathematics and other lessons, and has been reported in various studies conducted in the working-class schools in South Africa (e.g. Adler, 2002; Watson, 2000: 103-108; Brodie, 2004: 4-6; Talasi, 2007: 84; Dowling & Brown, 2009: 16). The studies revealed that chorusing normally occurs when the teacher raises his/her voice and pauses near the end of an intended statement, indicating that the students should join in to complete the statement.

Brodie (2004: 6) indicates that chorusing may function in two ways. It could, on one hand, serve to mark out what may be important in classroom discourse and be a way of holding students' attention because they have to be alert to both what and when to chorus (p. 6). On the other hand, she argues, chorused answers are usually short and very often obvious, thus requiring students to participate at a superficial level. Watson (2002: 39) argues that the words that complete a sentence may be determined by the rhythm of speech rather than active, intelligent

informed choices. In addition, she indicates that chorusing could also be used to recite the facts required for solving a problem. However she concluded that some students did not really have an idea of how the facts could be used because most students in her study failed to produce correct solutions when doing the exercises individually (p. 39).

The discussion shows that the pedagogic modalities used by teachers in South African schools differ according to social class background of students. The following section concentrates on the literature that focuses on teacher questioning in the pedagogic environment.

2.4 Teacher questions

Moyer & Milewicz (2002: 310) argue that questioning interactions are a significant part of mathematics teaching and learning in the classroom. In addition, Boylan (2002: 5) argues that the manner in which teachers and students interact through questioning both characterises, and is also productive of, the broader range of classroom practices and therefore could provide insights into the nature of these social practices. Hence teacher questioning has been used as the unit for analysis of data in a number of studies in mathematics education (see, for example, Nicol, 1999; Wimer et al, 2001; Brodie, 2004; Boaler & Brodie, 2004; Talasi, 2007). There are some studies which specifically investigated the types of teacher questions in pedagogic situations.

In their study Franke et al, (2009: 383-389) focus on teacher questions which aim to follow up on students' initial explanations and build on these explanations. The questions were usually presented as requests for students to elaborate on their implicit explanations, in an attempt to find out the underlying reasons for their errors, and also to emphasise important mathematical ideas. In their conclusions they argue that teacher questioning can facilitate the students' thinking in relation to mathematics in ways that support student understanding (p. 392).

Similarly, the results of Martino & Maher's (1999: 75) study suggest that teacher questioning directed at probing students' justification of solutions is beneficial for stimulating students to re-examine their original solutions in an attempt to offer an explicit explanation. Moreover, teacher questioning can invite students to reflect on their own ideas and it can open doors for teachers and students to become more aware of each others' ideas.

Matthiesen (2006: 52) argues, in addition, that the instructional setting has a significant impact on the types of questions that teachers could possibly ask in the pedagogic situation. The findings of her study suggest that small group instructional settings produce more questions, and

more questions of high-order type, than whole group instructional settings. She further argues that the type of questions encouraged students to analyse, synthesise, or evaluate information presented in order to provide a solution (p. 6).

Matthiesen (2006: 53) indicates that in one class the teacher used whole-group questioning in the lesson and often asked low-order questions defined as ‘questions that are procedural or knowledge-based, that ask students to recall an answer straight from memory’, and that often require brief one to two word answers (p. 6). She further reports that students were very passive and given very few opportunities to expand their thinking in relation to the task at hand. She arrives at the conclusion that whole-group lessons were not a beneficial setting for communication of mathematical ideas in the classrooms.

This concludes the discussion of literature which has been most significant in informing this study. The final section of this chapter will contain a synthesis of the main issues that emanate from the discussion.

2.5 Summary

This chapter aims at establishing the empirical focus of this study through the discussion on the works of sociology of education and mathematics education. The discussion reveals that social class reproduction takes place in two different environments, namely, home and school. Firstly, the arguments outlined in discussion indicate that children in their early years are oriented to language-use differently, depending on the social class background of their families. As a result, working-class children are predisposed to relate to the world in ways different from middle-class children as they are socialised in different ways. Secondly, it is argued that schooling plays a major role in perpetuating this difference by selectively distributing knowledge to students depending on their social class circumstances, with the result of satisfying the requirements of the labour market.

The selection of the work discussed also indicates that teachers elaborate knowledge according to their perceptions of the ability of students. It is also argued that teachers transmit mathematics criteria to students according to their social class background. This background also influences the teaching strategies that teachers use in the different social class contexts. Moreover, the discussion has shown that the social class status of the students has an impact on the interaction of the pedagogic subjects at the classroom level. In addition, evidence from the

relevant literature reveals that there is a possibility that social solidarity may influence the structuring of pedagogic communication. Most importantly, the literature has shown that questioning interactions are a significant part of mathematics teaching and learning in the classroom.

The empirical analysis of literature (see Jaffer, 2009) that focuses on the relationship between social class membership of students and pedagogic practice shows that teacher questions and student responses during the lesson can be used as a unit of analysis to identify whether pedagogic modalities used by teachers are communalising or individualising. In this study the different pedagogic modalities manifested in teacher questions and students' responses in different classroom settings will, for the moment, be dislocated from their relation to social class for the purposes of generating data, and then reconsidered in relation to social class once the data has been produced and analysed.

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Chapter 3

Theoretical framework

The aim of this study, as mentioned before, is to investigate how forms of social solidarity influence the structuring of pedagogic communication and how they are implicated for making available data, to the teacher, of what it is that students have constituted as criteria for the production of legitimate text. This chapter outlines the theory that informs the study. The purpose of this chapter is to generate a set of propositions from which an analytical framework will be derived in Chapter Four. The propositions will be generated out of a discussion of a work which has been central in providing inspiration for this dissertation.

The main theoretical resources that are drawn on emerge from the following sources: Durkheim's theory of social solidarity; Bernstein's theory of the pedagogic device and the related work; and Dowling & Brown's (2009) discussion of the relationship between pedagogy and community in three South African schools. Discussions of forms of social solidarity in the context of education feature in the works of Bernstein (1975), Atkinson (1985), Davies (1994), Davis (2005) and Dowling & Brown (2009). Discussions of Bernstein's pedagogic device and framing principles are recruited by numerous scholars, e.g. Muller (2000), Muller et al. (2004), Singh (2002), Hoadley (2005) and Davis (2005).

The discussion will commence with a detailed account of pedagogic modalities proposed by Dowling & Brown (2009) on the effect of social class on pedagogic practice. Next, Durkheim's theory of social solidarity will be described, after which a description of pedagogy using Bernstein's (1996) notion of the pedagogic device, with special reference to evaluation, will be offered. Bernstein's notion of framing will also be employed to show the potential implications related to the control over the rules of social and discursive order in different pedagogic situations. The elements of framing are used to describe features of the social solidarity that appear to be in place in any pedagogic context. The manner in which Bernstein and neo-Bernsteinian scholars have recruited Durkheim's theory will also be examined. Finally, out of the discussion, theoretical propositions which will orient the work of the subsequent chapters of the dissertation will be generated.

3.1 Pedagogic modalities

Dowling & Brown (2009) postulate the existence of a specific set of relationships between the social solidarity that pertain in schools and the ways in which pedagogy unfolds in those schools. The three schools that feature in their study were distinguished by the social class membership of the students attending the schools, with specific types of social solidarity found to be correlated with specific social classes. The first school was predominantly populated by upper middle-class students, the second predominantly by working-class students, and the third was a 'hybrid', populated by both middle-class and working-class students.

Dowling & Brown report that when engaging with working-class students, teachers tended to interact with their classes as 'communal subjects', indexing what they referred to as a *communalising pedagogy* (p. 163-164). For example, when a few students failed to complete their homework, the teachers would often punish the whole class, so that the actions of individual students were treated as though they were those of the whole group. The manner in which teachers and their students interacted made it difficult to attribute authorship of any text to any single individual, other than the teacher in those instances when the teacher did all the talking and writing. In other words, while an observer might witness the class working through mathematics content, the observer would, however, not be able to say what it was that any particular individual student knew about the content, but only that the class had apparently covered the content.

In the upper middle-class school, the situation was different from the previous case. Dowling & Brown (2009: 155) report that students were generally admitted to the school on merit (on the grounds of their academic records). They also indicate that the disciplinary measures for dealing with students who breached any of the school's regulations were mostly restitutive. For instance, failure to produce homework resulted in detention. They mention that latecomers could face detention and/or be denied access to the lesson for which they had arrived late. During the lessons teachers interacted with students as individuals, indexing what the researchers termed an *individualising pedagogy*. For example, in one class the teacher arranged the class into groups of different sizes and assigned them tasks. While the students were still working the teacher moved around the class interacting with individuals in each group, offering specific help where necessary (p. 156).

The third school served a mixed population of middle- and working-class students. Dowling & Brown (p. 150) indicate that the geographical catchment community of that school was highly complex in terms of class, religion and ethnicity, and they referred to it as

an instance of *class condensation*. They noticed that within the same pedagogic setting both individualising and communalising pedagogic modalities were used. In a mathematics class, for example, they observed that a teacher initially used individualising strategies of differentiating the ‘good’ from the ‘bad’ students in class by displaying the students’ books in two piles, based on whether they completed their homework or not. The teacher also announced that the students who had not completed their homework would lose their marks as punishment and have to do additional homework. They report that the teacher recruited some of the students who had completed the homework to put their solutions up on the board. During the course of the lesson, the whole of the class seemed, in the teacher’s view, to have been rehabilitated but at the end of the lesson the teacher returned to the homework issue, and announced the additional punishment of homework for everyone, including those who had done the homework originally. This shows that the class which had been divided at the start of the lesson was reunited at the end through the employment of a communal strategy (p. 173-174).

As stated earlier, the notions of communalising and individualising pedagogies derive from Dowling & Brown’s (2009) appropriation of elements of Durkheim’s (1984) theory of social solidarity and the work of Bernstein (1996). In the following section, Durkheim’s description of social solidarity and its two fundamental modes will be examined.

3.2 Durkheim’s account of forms of social solidarity

When defining social solidarity, Durkheim (1984: 58) states that it is ‘a wholly moral phenomenon which by itself is not amenable to exact observation and especially not to measurement’. He points out that ‘where social solidarity exists, in spite of its non-material nature, it does not remain in a state of pure potentiality, but shows its presence through perceptible effects’. He argues that law is a visible sign to illustrate the presence of social solidarity. He also associates the forms of social solidarity with the division of labour present in different types of societies.

Explanations of the fundamental modes of social solidarity, which are mechanical and organic solidarity, are given below.

3.2.1 Mechanical solidarity

Durkheim (1994: 58) argues that there is a social structure of a determinate nature to which mechanical solidarity corresponds. He claims that the social organisation of societies comprising a system of unilateral parts similar to one another exhibits *mechanical solidarity*.

He takes into consideration the common sentiments and beliefs shared by 'primitive' societies, arguing that since social masses of that kind were formed from homogeneous elements, the shared or communal responsibility was highly developed. This suggests that in these arrangements, there is an emphasis on sameness.

Secondly, Durkheim notes that there are some 'primitive' societies that are subject to an absolute power. He exemplifies this by discussing the relationship of the 'barbaric despot' with his subjects, which is much like that of the relationship of masters with their slaves. Nonetheless, the despot could not break the law because whatever he did immediately announced and defined the law. These two cases show that that kind of social cohesion places more emphasis on the *similar to* relations to the members of each society.

3.2.2 Organic solidarity

Durkheim (1984: 67-68) argues that the structure of societies where organic solidarity is preponderant displays elements which are not of the same nature, nor are they arranged in the same manner. He emphasises that these elements are 'coordinated and subordinated to one another around the same central organ, which exerts over the rest of the organism a moderating effect' (p. 68). In addition, he indicates that there is differentiation in the character of organs, resulting in a mutual interdependence with each other. He states that,

[t]his social type relies upon principles so utterly different from the preceding type that it can only develop to the extent that the latter has vanished. Indeed individuals are distributed within it in groups that are no longer formed in terms of any ancestral relationship, but according to the special nature of the social activity to which they devote themselves. Their natural and necessary environment is no longer that in which they were born, but that of their profession (Durkheim, 1984: 68).

He remarks, significantly, that an organ operates because of the nature of the role that it fulfils and not due to some cause external to its functions or to some external force imparted to it. This suggests that the individuals within the same society have different roles to play, based on the different types of expertise that they have acquired. From this description, it can be deduced that societies that exhibit organic solidarity consider important differentiation of individual members who populate such societies. He argues that modern societies, which are characterised by complex divisions of labour, exhibit organic solidarity.

In the next section, the arguments that recognise law as being a visible symbol for illustrating the presence of social solidarity in societies will be critically examined.

3.3 Law as a dimension of social solidarity

Merton (1934, p 319) indicates that Durkheim used the categories of repressive and restitutive law as indexes of mechanical and organic solidarity, respectively. He also points out that in the society-type characterised by uniform beliefs and practices, which Durkheim calls 'primitive', there are laws imposed on individuals intended to keep them under threat of repressive measures. Merton argues that these penal laws could be manifestations of the existence of mechanical solidarity (p. 320).

When explaining how *penal* law functions, Durkheim argues that

[the] acts which such law forbids and stigmatizes as crimes are of two kinds: either they manifest directly a too violent dissimilarity between the one who commits them and the collective type; or they offend the organ of the common consciousness. In both cases the force shocked by the crime and that rejects it is thus the same. It is a result of the most vital social similarities, and its effect is to maintain the social cohesion that arises from these similarities. It is that force which the penal law guards against being weakened in any way. At the same time it does this by insisting upon a minimum number of similarities from each one of us, without which the individual would be a threat to the unity of the body social, and by enforcing respect for the symbol which expresses and epitomises these resemblances, whilst simultaneously guaranteeing them (Durkheim, 1984: 63).

In describing organic solidarity, Merton states that this is

based upon the interdependence of cooperatively functioning individuals and groups. This type of solidarity is indexed by juridical rules defining the nature and relations of functions. These rules may properly be termed restitutive law, since their violation involves merely reparative, and not expiatory, consequences (p. 320).

In considering the manner in which *restitutive* law operates Durkheim argues that 'the kind of sanctions [that are instilled by this type of law] do not necessarily imply any suffering on the part of the perpetrator, but merely consist in *restoring the previous state of affairs*, re-establishing relationships that have been disturbed from their normal form' (p. 59).

The majority of present day societies use law for controlling the integrations of the individuals. Even though law is important for regulating the social interactions, this study contends that moral order dominates in a micro level of pedagogic practice. In other words, teacher-student and student-student interactions are mainly regulated by a moral order during pedagogic communication. The participants involved in a particular pedagogic context could

have the same opinion regarding what is considered to be acceptable conduct, and this is an end result of moral order. In other settings, the moral order could be contrary to the law. For instance, some working-class schools in the South African context still use corporal punishment, as per agreement between the stakeholders in such schools. However, any form of assault is considered a criminal offence punishable by law. This suggests that the law is secondary to moral order in pedagogic situations. Therefore it would be important to consider moral order when examining issues concerning social solidarity in pedagogic situations.

From this discussion it can be deduced that the inter-relations between the human subjects caught up in pedagogic communication constitute some forms of social solidarity. In view of the fact that education resides in the social context which has an effect on pedagogic practice, it is possible that social solidarity could be employed for investigating the interactions of interlocutors at the classroom level. One has, however, to consider the original intention of this theory. As Dowling & Brown (2009) argue that there is a relationship between forms of social solidarity and the structure of pedagogy, it is essential to provide a description of pedagogy. This is important for establishing the links between these two ideas.

3.4 Pedagogy

The notion of pedagogy is a central component of any classroom practice which involves the interactions between the teacher and students which translate to the creation of criteria for production and reproduction of texts. Bernstein (1996: 43) argues that pedagogy is always evaluative. He argues, further, that pedagogy attempts to make explicit the principles, procedures and texts to be acquired. Additionally, Bernstein (1973: 85) notes that ‘pedagogy defines what counts as valid transmission of knowledge, [whereas] evaluation defines what counts as a valid realization of the knowledge on the part of the taught’. Bernstein (1996) formulated the pedagogic device which serves to describe the manner in which knowledge is transformed into pedagogic communication.

3.5 Pedagogic device

Bernstein’s (1996) notion of the pedagogic device is very helpful for understanding pedagogic communication. Bernstein (p. 46) argues that the device provides the ‘intrinsic grammar’ for pedagogic discourse through three interrelated rules, namely: *distributive rules*, *recontextualising rules* and *evaluative rules*. He states, firstly, that the function of the distributive rules is to regulate the relationship between power, social group, forms of consciousness and practice (p. 46). In other words, distributive rules regulate who gets what

kind of knowledge. Secondly, he indicates that recontextualising rules regulate the formation of pedagogic discourse (p. 46). This issue will be discussed in detail in Section 3.7. Thirdly, Bernstein argues that evaluative rules constitute any pedagogic practice (p. 43).

Bernstein argues that continuous evaluation is the key to pedagogic practice and that evaluation condenses the whole of the pedagogic device (Bernstein, 1990: 186-187; 1996: 50). He points out that evaluative rules construct pedagogic practice by providing the criteria to be transmitted and acquired (Bernstein, 1996: 118). Most importantly, evaluative rules act selectively on contents, the form of transmission and their distribution to different groups of pupils in different contexts. Evaluative rules provide a symbolic ruler for consciousness (p. 50). Evaluation plays a regulatory role with respect to the kind of criteria that are realised and how they are realised. Apart from that, evaluation plays a role in measuring the state of acquisition of such criteria. As pointed out earlier, evaluation defines what counts as a valid realisation of the knowledge.

As argued earlier, the purpose of any pedagogic practice is for the transmission and acquisition of criteria. This study investigates how different kinds of social cohesion could be manifested through evaluation in the pedagogic situations. This is because, in any form of social organisation, individuals that form a part of a unit or group are brought together by social solidarity. This means that the social unit has the set of regulatory rules that were agreed upon, which keep the relations between members intact. These rules regulate individuals' sense of belonging to the group. In other words, social solidarity have a structural effect on the social interactions which legitimises the inclusion/exclusion of the individuals in the group.

According to Bernstein (1996) pedagogic discourse, which comprises both regulative and instructional discourses, is the key for regulating transmission and acquisition of the criteria for production and reproduction of pedagogic texts. The forms of social control operational in pedagogic contexts are very important for providing information pertaining to the conditions of the moral order within such settings. Bernstein's framing principles which specifically draw attention to the forms of social control in any pedagogic situation are examined below.

3.6 Framing

For Bernstein (1995: 7; 2000: 99), ‘framing is conceptualised as the locus of control over pedagogic communication and its context. Framing varies according to whether the locus of control is towards the transmitter or towards the acquirer’. In other words, framing values shape the form of pedagogic communication and its underlying context. In addition, Bernstein (1996: 27) indicates that two systems of rules regulated by framing can be distinguished analytically in terms of rules of social order and rules of discursive order. He associated the first with *regulative discourse* and the second with *instructional discourse*. Of the two, the form of social ordering (regulative discourse) is the fundamental element in pedagogic relationships. Bernstein represented this proposition symbolically as: $\text{Framing} = \frac{ID}{RD}$ (Bernstein, 1996: 28). This shows that, for Bernstein, framing, which he thinks of as an instructional discourse embedded in a regulative discourse, is *pedagogic discourse* (p. 28). When providing a description of pedagogic discourse, Bernstein (p. 46) states that ‘[it] embeds rules which create skills of one kind or another [i.e., instructional discourse] and rules regulating their relationship to each other, and rules which create social order [i.e., regulative discourse]’. For Bernstein, the regulative discourse creates rules of social order that generate criteria which map out the contours of a moral discourse.

Even though it is indicated that regulative discourse is central to pedagogic relationships, Bernstein argues that the framing values with respect to regulative discourse and instructional discourse can vary. He emphasises that these discourses are not always complementary to each other. Apart from that, different framing values transmit different criteria for the creation of pedagogic texts.

The discussion presents the importance of pedagogic discourse (i.e. in the form of framing) for describing social relations in the ‘micro-interactional’ level of classroom. Dowling (2009: 80-82) challenges Bernstein’s description of the concept of pedagogic discourse. He argues that Bernstein’s theorising of this concept constitutes an ‘unnecessary priority’ of certain terms. Dowling suggests that this situation may result in ‘confusion’, because of the lack of consistency in key terms that Bernstein employed. Besides that, he argues that Bernstein made empirical claims but provided quasi-empirical illustrations in order to bolster his theoretical apparatus. These criticisms, however, are unconvincing because they fail to contend against the significance of social order in the pedagogic communication. He does not pinpoint the shortcoming of pedagogic discourse, except the issue of who is responsible for recontextualising knowledge from the field of production.

This theory indisputably remains relevant, and could be useful for examining the social relations in classrooms, contrary to claims made by Dowling.

It is essential to describe the structure of framing in terms of regulative discourse and instructional discourse (as shown in Fig 3.2). This is important because the structure of framing provides possibilities for identifying the kind of social interactions functioning in particular pedagogic situations.

3.6.1 Regulative discourse

Hierarchical rules

For Bernstein (2003: 198), the rules of social order take the form of hierarchical relations between the teacher and the students. They establish the conditions for appropriate conduct in the pedagogic situation. In other words, these rules are essentially a prerequisite for any enduring pedagogic relation because they articulate the expectations about conduct, character and manner (Bernstein, 1996: 27). Bernstein argues that the hierarchical rules may, to different degrees, permit a space for negotiation in any pedagogic relation. The hierarchical rules also describe contextual features of the pedagogic communication, including the structuring of spatial distribution.

The strength of framing could be considered as control over regulative rules of social relations and the contextual attributes in the pedagogic situations. Strong framing implies that the teacher has more control over social relations and the contextual features of the pedagogic communication. Weak framing implies that the students have apparent control over social relations together with contextual attributes.

After this discussion of the characteristics of the regulative discourse in the form of hierarchical rules, the rules of discursive order will be focused on in the next subsection.

3.6.2 Instructional discourse

With regards to the rules of discursive order, 'framing refers to the degree of control teacher and pupil possess over the selection, sequencing, pacing and evaluation of the knowledge transmitted and received in the pedagogical relationship' (Bernstein, 1971: 206). Besides that, the strength of framing is characterised by the degree of control that the teacher and students have over the framing rules that regulate what is transmitted and acquired. Each of the framing principles is described below.

Chapter 3

Selection

For Bernstein (1981: 329), selection contributes to the realisation of specific textual productions. He states that ‘the selective creation, production, and changing of texts is the means whereby the positioning of subjects is revealed, reproduced, and changed’ (p 329). This suggests that the selection of what is to be acquired is the principle adopted by teachers in order to create and classify the contents to be acquired and the context in which it is acquired (Bernstein, 2003: 202). The strength of framing could be measured by considering whether it is the teacher who has control over selection rules or the control is in the hands of the students. If it is the teacher who has control over selection of the contents during the lesson, then framing of selection is said to be strong, when the students have control over selection, framing is said to be weak.

Sequencing rules

The main purpose of sequencing rules is to regulate the ordering of content during the lessons. Sequencing is very important for lesson planning, in that the teacher may map out a series of activities in a particular order for engaging students. Sequencing rules help the teacher to conceptualise the manner in which he/she should approach a topic (i.e. to make decisions on what should come first and what should follow). For example in the initial stages of the lesson the teacher may choose to introduce a topic with a few worked examples, and later on may show the students how to deduce the actual principle or rule that the lesson was intended to establish. According to Bernstein (1994: 178), ‘the strength of the framing over the sequence regulates the strength of the steering by the teacher’. This implies that the strength of framing is determined by considering the degree of control that a teacher has over the ordering of pedagogic content during the lessons. Bernstein (2003: 198) argues, further, that ‘if there is a progression, there must be sequencing rules. Every pedagogic practice must have sequencing rules, and these sequencing rules will imply pacing rules’.

Pacing

Pacing is the expected rate of acquisition of the content, that is, the subject matter that students are expected to learn in a given amount of time. Due to the importance of pacing rules in pedagogic communication, Bernstein (2003: 207) argues that these rules can be regarded ‘as regulating the economy of the transmission and so these rules become the meeting point of the material, discursive, and social base of the transmission’. Pacing creates the rhythm of the communication, and rhythms of communication have different modalities.

This means that different modalities feature as a result of the control of pacing rules. For instance, if the teacher is interested in covering a prescribed amount of content within a certain time frame, communalising pedagogic modality is likely to dominate in the lesson.

Bernstein (p. 207) also argues that the time factor is the central object where there is strong pacing, stating that this ‘will tend to reduce pupils’ speech and privilege teachers’ talk, and the pupils come to prefer that, as time is scarce for the official pedagogic message. In this way the deep structure of pedagogic communication is itself affected’. When framing is weak, students would have apparent control over pacing rules. In other words, the rate of students’ acquisition of content would determine the pace of a lesson.

Evaluative criteria

According to Bernstein (2003: 198-199, 201), there are criteria that the students are expected to acquire and to apply to their own practices in any pedagogic situation. The evaluative criteria are the set of rules that make visible the kind of knowledge to be realised and the manner in which it has to be realised. They also enable the students to understand what counts as a legitimate or illegitimate communication, social relations, or positions in the pedagogic context. Strong framing occurs where the teacher’s control over these rules is explicit. Weak framing means that the student has more apparent control over them.

The level of framing across the aforementioned principles can vary independently (Bernstein, 2000: 12-13). Despite the fact that framing principles would be useful for describing the inter-relations in different pedagogic settings, there still exist some potential ambiguities in their application. For example, Morais, Neves & Afonso (2005) proposed a modality that represented mixed pedagogic practice that appeared to be appropriate in learning environments that involve children from socially varied backgrounds. They indicate that this modality was characterised generally by weak framing over the hierarchical rules and pacing, but very strong framing over the evaluative criteria, selection and sequence. One can argue that this modality might not be effective in some contexts. For instance, in schools that experience disciplinary problems, it is possible that when the teacher weakens framing of hierarchical rules the students might take advantage of that in order to avoid executing their usual responsibilities.

In other contexts, if the framing of evaluative criteria is strong but students fail to realise the pedagogic texts, this implies that the teacher may slow down the pace of a lesson in an attempt to help the students who encountered some problems. This may be problematic because it might result in the least amount of content coverage prescribed by curriculum.

The types of questions that teachers ask during lessons and the students' responses can provide information about the kind of framing principles that dominate pedagogic communication, hence that translates into the conditions of moral order in the pedagogic situations. Bernstein (1994: 178) indicates that pedagogic communication is an interrogative mode, where sequences of questions direct the students towards a pre-determined outcome known to the teacher. He also claims that one of the functions of questioning is to alert the student to relevant attributes, characteristics and features which would help them recognise and realise the criteria for the production of pedagogic texts (p. 178). In this regard, pacing regulates what questions may be put, and how many. Pacing also regulates what counts as an explanation, both in its length and form (Bernstein, 2003: 207). Lastly, the types of teacher questions and students' responses can provide information about the strength of framing of hierarchical rules. This suggests that, if the teacher addresses questions to individual students, he/she opens up the possibility of negotiations.

It follows from the discussion that framing principles provide information on how social interactions are regulated during pedagogic practice. The discussion presents the possibility of identifying the kind of social solidarity dominating in pedagogic contexts. It is now essential to return to Durkheim's theory and look at the different ways that it has been applied in the sociology of education.

3.7 Application of the theory of social solidarity in the education context

3.7.1 Bernsteinian approach on forms of social solidarity

Bernstein (1975: 79) using Durkheim's theory, argues that social interaction within the British schooling system in the 1960s and 1970s was shifting from mechanical solidarity towards organic solidarity due to the changes in the character of the education system. Bernstein placed his analysis of those changes in schools on Durkheim's notion of social solidarity as an integrating principle (1996: 100). According to Bernstein, 'the *stratified* schools [...] became Closed Types through mechanical solidarity, whereas *differentiated* schools were integrated through organic solidarity' (1996: 100). He defines the stratified schools as those schools where the unit of organisation was based on the fixed attributes, whereas the *differentiated* schools were those that consider the development of student's 'cognitive ability' as a process not centred on the predetermined attributes (Bernstein, 1966: 433). He argues that 'cognitive ability' develops differently for each student, and that this process of development can be shaped and modified by the social context (p. 433).

Bernstein (1975: 79-80) states that staff members shared responsibility for teaching and teachers' roles were fragmented to provide different specialised services to students (ranging from vocational, counselling, housemaster, social worker, etc). He also indicates that the division of labour was more complex and individual teachers specialised in different school subjects. He claims that the central object of pedagogic practice was for the transmission of knowledge in a way that showed a realisation of differentiation in competencies with respect to the acquisition and reproduction of pedagogic texts. For Bernstein, that presented good evidence of a shift towards organic solidarity (1975: 80). This approach informed much of his work, as well as a number of research studies in the sociology of education (for example Atkinson, 1985; Sadovnik, 1991; Power & Whitty, 2002; Hoadley, 2005; Dowling & Brown, 2009).

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Table 3.1 illustrate the dichotomous view of social solidarity that Bernstein⁶ and neo-Bernsteinian scholars⁷ set out.

Category	Middle class	Working class	Reference(s)
Social integration	Organic solidarity	Mechanical solidarity	Bernstein, 1975: 67
Division of labour	Complex	Simple	Bernstein, 1975: 67 Hoadley, 2005: 258
School types	Open type/differentiated	Closed type/stratified	Bernstein 1996: 100
Boundary relationship	Open	self-enclosed/sharply defined	Bernstein, 1975: 69, Atkinson, 1985: 36
Languages	Formal	Public	Bernstein, 1971: 28
Orientation to meaning	Context-independent	Context-dependent	Bernstein, 1971: 29; Holland, 1981: 5; Hoadley, 2005: 167.
Authority relationships	Personal	Formal or positional	Bernstein, 1975: 69
Social relations	Contractual	Consensual/affective	Dowling & Brown, 2009
Social interaction	Individualising	Communalising	Bernstein et al., 1966: 434; Bernstein, 1975: 67
Social organization	A flexible or variable unit	A fixed structural unit	Bernstein, 1975: 68
Social roles	Achieved/co-operative	Ascribed/assigned	Bernstein, 1975: 69;
The role of pupil	Greater choice	Circumscribed and well defined	Bernstein, 1975: 69
Social control	Recognition of differences between individuals/ Individualised/therapeutic, 'guilt'	Common or collective values/ punishment, 'shame'	Bernstein, 1975: 67; Atkinson, 1985: 36
Social order	Cooperation	Domination	Bernstein et al., 1966: 434
Pedagogy	Emphasises the exploration of principles	Emphasises the learning of standard operations tied to specific contexts	Bernstein, 1975: 68
Pedagogic modalities	Individualising	Communalising	Dowling & Brown, 2009

In the next discussion, which is largely drawn from Atkinson (1985), it is deemed Bernstein and neo-Bernsteinian scholars share the same opinions with regards to social solidarity. Atkinson's commentary, in particular, is found to be useful because it reiterates Bernstein's views in application of this theory. For Bernstein and neo-Bernsteinian scholars, social solidarity in the pedagogic situations are determined by the social class background of students. They associate working-class context with mechanical solidarity and middle-class

⁶ Bernstein (1971, 1975, 1990, 2003).

⁷ Some of the works of neo-Bernsteinian scholars who recruited social solidarity theory in the manner illustrated in Table 3.1 are: Grimshaw, 1976; Gorder, 1980; Atkinson, 1985; Dowling & Brown, 2009.

context with organic solidarity. These scholars argue that in the working-class context, units of social organisation are arranged in the manner intended to maintain internal homogeneity. One could challenge this assertion by pointing out that even in the middle-class schools emphasis on uniformity in the social organisation is evident. For example, most of the middle-class schools admit students on the basis of their academic excellence and financial circumstances. In that sense, the students who are not able to meet the requirements would be excluded, because of the emphasis on the need for uniformity in respect of these criteria. If one takes into consideration the fact that modern societies (especially those that are urbanised) are caught up in the complex division of labour, their argument that working-class settings exhibit simple divisions of labour is not supported.

Atkinson (1985: 26) argues that in societies indexing mechanical solidarity, students were categorised into streams in terms of *ascribed* roles or characteristics. He argues that the students were streamed on the basis of measured abilities, which were considered to be the stable aspects for classifying them. In other words, the students were classified in the same way across grades and school subjects. On the other hand, Atkinson argues that in schools that display characteristics of organic solidarity, emphasis tends towards establishment of *achieved* roles for students. This means that a student's ability is judged in terms of the outcomes of his/her interaction with the teacher in the learning process. According to Atkinson, ability might be considered to be manifested in the different pedagogic contexts (p. 26). Besides that, Atkinson argues that in modern schools social control appears to be more personalised or individualised, whereby students and teachers interact as individuals. Otherwise, the social arrangement that indexes mechanical solidarity was argued to be based upon positional categories (p. 26-27).

Atkinson also argues that boundaries in the schools exhibiting mechanical solidarity are characterised by highly developed rituals which they categorised as being consensual. Such rituals, he avers, bind the school into a single "collectivity resting upon, among others, consensual lineaments of dress, imaginary signs, totems, historical texts and symbolical features, while schools exhibiting organic solidarity are likely to be based upon individualised and interpersonal relations, resting upon 'differentiating rituals'". Differentiating rituals, thus, disconnect the various groups and segments within the school in terms of ability, gender or age. Additionally, Atkinson argues that 'differentiated schools' are characterised by interpersonal control which can be referred to as 'therapeutic' – resembling Durkheim's description of restitutive law. Bernstein (1966: 31) argues that within 'stratified schools' the interpersonal control rests upon sentiments of 'shame', whereas within the

‘differentiated schools’ the corresponding sentiment is that of ‘guilt’.

An issue that could be raised in respect of the above-mentioned arguments is that some of the elements that are associated with mechanical solidarity are still noticed in the middle-class schools. For example, most school uniforms, regardless of social class, have emblems on them. That alone, however, could not qualify the school as falling under mechanical solidarity. With regards to law, most contemporary societies have some elements of restitution in their legal systems. It is inappropriate, therefore, to consider that different social classes or groups coexisting in the same period practise different types of law. This suggests that the way Bernstein and neo-Bernsteinian scholars used Durkheim’s theory is problematic and open to a great deal of criticism.

These propositions are not entirely untrue, but their rationale does not follow Durkheim’s original deployment of this theory. Bisseret (1979) has criticised Bernstein for misinterpreting Durkheim’s theory from its initial intent. His main argument is that Bernstein subjected Durkheim’s ideas to a personal reinterpretation (p. 103). He has also argued that Bernstein applied the distinction to the same type of society. According to Bisseret, attributing social solidarity in the same type of society on the basis of social class would be ‘to consider classes as closed systems with a relationship of co-existence and not of reciprocal dependency’ (p. 103). The counter-argument used by Atkinson (1985: 25) is that a similar approach for making distinction between contrasting modes of organisation within the same type of society had been used before by researchers such as Burns & Stalker (1961), Hickson (1966) and Weeks (1973) who were interested in ‘Industrial Administration’. Burns & Stalker’s (1961) ideas of ‘mechanistic’ and ‘organic’ orders of management systems may, on the surface, appear to be indistinguishable from Bernstein’s application of the social solidarity theory. They describe ‘mechanistic’ management systems as being characterised by fixed specifications of job roles. The role of executives within the organisation is said to be largely concerned with maintaining conformity to the divisions of positions and functions. An organic management organisation is said to display evidence of the continual adjustment of task roles. Authority relations are arguably much less rigid and the communication network much more diverse. It is essential to scrutinise the manner in which the notion of management systems operates in industrial enterprises, so that we can compare it with the idea of social solidarity.

According to Burns & Stalker (1961: 103) management systems came about in response to the growth of industrial enterprises and the variety of individual tasks that increased with the division of labour and the development of technology. They argue that management systems

were created as a way of directing, co-ordinating, and monitoring the activities of a large numbers of workers. Different forms evolved in different organisations. Burns & Stalker argue that types of working organisations were ‘deliberately created and maintained to exploit human resources of a concern in the most efficient manner feasible in the circumstances of the concern’ (p. 119). Most importantly, they argue that the effective organisation of industrial resources would not approximate to one ideal type of management system, but could alter in important respects to conform to changes in intrinsic factors⁸ (p. 97). This implies that the two management systems can co-exist within the same enterprise. But the one implemented depends on the prevailing conditions at the particular point in time. Burns & Stalker (1961) indicate that the mechanistic management system is appropriate to stable conditions whereas ‘*organic* form is appropriate to changing conditions, which give rise constantly to fresh problems and unforeseen requirements for action which cannot be broken down or distributed automatically arising the functional roles defined within a hierarchic structure’ (p. 119, 121). The two concepts are not only fundamentally different, but they also appear to contradict the Bernsteinian application of the social solidarity. This suggests that Atkinson defends inaccurately Bernstein’s use of forms of social solidarity in the same society.

The next section considers arguments supporting Durkheim’s deployment of the theory of social solidarity.

3.7.2 Scholars who support Durkheim’s deployment of the social solidarity

Galant (1997) uses the theory of social solidarity in her study in which she investigated the research reports of South African Human Sciences Research Council (HSRC). The reports are said to have informed decisions that led to the construction of the different mathematics curricula during the apartheid era. She established that the reports suggested that the curricula should be designed in compliance with the racial differences of the acquirers, with the aim of meeting the demands of the labour market. She states that the reports on the one side of spectrum suggested that

“practical and functional” mathematics courses for black acquirers must provide access to “mathematical insight, logical argument and problem solving” in so far as they relate to work problems. In this way, mathematics will provide opportunities for some mobility between black workers in that they would be “skilled” to perform a

⁸ Burns and Stalker (1961: 97) define intrinsic factors as all identifiable different rates of technical or market change.

wider variety of tasks. The exclusion of abstract and generalised mathematics from courses for black learners suggests that this mobility is limited to the lowest levels of the labour market. That is, from manual to semi-skilled labour, where mathematical insights allow them to become more effective workers (Galant, 1997: 112-113).

In addition the recommendations of the reports suggested that the consciousness of the learner must be geared towards group performance, the reason being that the skills and competencies acquired this way were considered necessary for the efficient functioning of teamwork in the labour market. Since they are common to all, their coherence would depend on the group identity (p. 114). The *similar to* relations, according to Galant, imply *mechanical solidarity* (p. 115). This also suggests that if workers leave the job, their absence (and replacement by others) might not have any negative impact on the production of commodities with regards to the labour force.

Galant (1997: 116) also indicates that the reports described 'the white acquirer as one who has an innate disposition to be curious and to explore his environment and is predisposed to thinking creatively, abstractly and independently'. This, then, justified the exposure of the white acquirers to abstract and generalised mathematics in order to develop and strengthen their positive human potentialities. This also implies the optimal development of their particular potentialities for their future employment. The independence in making choices for these learners specifies their differences, indexing *organic solidarity* (p. 123). This suggests that the mathematics curricula designed for the acquirers of different racial groups were shaped alongside the economic demands. One could argue that even in the design of the curriculum in the post-apartheid era, a similar trend was followed.

Davis (2005: 64) contends that the proper way of using both mechanical and organic solidarity could be by taking them as the modes of expressive order, not strictly tied to division of labour, so that they could be observed across all societies. In the descriptions of modes of social solidarity made earlier, Durkheim indicates that the notion of communism indexes mechanical solidarity. Communism as the mode of production presently used in Cuba has shown itself capable of existing in societies exhibiting a highly complex division of labour. It would, therefore, be misleading if forms of social solidarity were only perceived along the lines of division of labour.

The army is a typical example of a social organisation that exhibits characteristics of both *similar to* and *different from* relations in the modern societies. The *similar to* relations presented in the army are manifested by the way recruits are trained, their identity in the form of uniform, haircuts, the same type of food they eat, and the kind of punishment for

misconduct meted out on them. The recruits are also taught the importance of allegiance to the group. In that sense, if the individual member of the battalion should misbehave it is likely that the whole battalion would face the same form of punishment. This then means that an individual is loyal to the group and will avoid letting down his/her squad mates. One could conclude that social organisations like the army exhibit mechanical solidarity. However, some members of the army are professional groups such as engineers, medical practitioners, pilots, councillors and lawyers. These few examples, which index the existence of both *similar to* relations and specialisation in the army, demonstrate that it would be inappropriate to use Durkheim's theory in order to describe the relations within the army. This is because, for Durkheim, one form of social solidarity comes into play when the other is not present.

It follows from this discussion that one has to be careful when employing the notion of social solidarity, especially in pedagogic practice in the urban environment. The notion of communalising and individualising pedagogic modalities should never be associated with the idea of social solidarity, although there are some commonalities between them. Unlike social solidarity, communalising and individualising pedagogic modalities can be justified empirically, and can be manifested in any form of pedagogic communication across all societies. The criteria for the production and reproduction of pedagogic texts are realised through evaluation. Therefore, contrary to what Bernstein and scholars who follow him want us to believe, evaluation dominates the pedagogic practice and it is not entirely impacted on by forms of social solidarity. It is through evaluation that pedagogic practice in schools that differ in social class membership of the students and teachers can be observed. The questions that teachers ask are very useful in establishing the types of pedagogic strategies that are used in different pedagogic situations. It would not be too difficult, in view of the types of questions that are prevalent in the pedagogic situation, to observe whether the pedagogic strategies that teachers use are individualising or communalising. If the latter strategy dominated the lesson, the teacher would not be able to determine the status of acquisition of the individual students in the classroom, as he/she would have derived information from consensual responses which are often misleading.

This now concludes my discussion of the theoretical work which has been most influential in generating the propositions upon which my analytical framework is based. In the final section of this Chapter I shall present the propositions.

Summary: theoretical propositions

The theoretical propositions given below constitute a summary of the key points in the preceding discussion. The theoretical propositions referred to in subsequent chapters form a basis of this study. This is because they will be used for the purpose of understanding and interpreting the findings.

- (1) Criteria required for the production of texts in the pedagogic situations of schooling are carried by pedagogic communication (Bernstein, 1996).
- (2) Teachers in different schools use different pedagogic strategies for gathering information about the students' acquisition of criteria. These strategies have structuring effects on pedagogic communication, producing at least three pedagogic modalities: *communalising* and *individualising pedagogies* and the blend of the two (Dowling & Brown, 2009).
- (3) Through their differential effects on pedagogic communication, different pedagogic modalities affect the way in which criteria are acquired by individuals in different ways (Dowling & Brown, 2009).
- (4) Pedagogic modalities in situations dominated by working-class students tend to be communalising, and in situations dominated by middle class students, tend to be individualising (Dowling & Brown, 2009). In pedagogic situations where there is a clear difference in the social class base of students and the primary social class base of teachers, the tendency will be towards pedagogy that blends features of communalising and individualising pedagogies.
- (5) Framing principles structure the control of communication within any pedagogic context. The strength of framing over both the instructional discourse and regulative discourse are evidence of the modalities prevailing in the pedagogic situations.

Chapter 4

Analytical framework

The primary focus of this chapter is the development of the descriptive and analytic resources used to describe the general methodology that will be employed for data production and interpretation of the findings. The chapter consists of two main components: the first focuses on the social organisation in the schools, and the second gives attention to the evaluation by examining the types of questions that teachers ask in the lessons.

In the first instance the contextual background of the schools where information was derived from will be described. Secondly, a description of the archive of information will be provided. Thirdly, the framework for categorising the aspects of social organisation in the pedagogic situation will be outlined. Finally, a description of the procedure used to develop methodology that focuses on the evaluation will be given, focusing particularly on the questions that teachers ask during the lessons.

4.1 Research Methodology

4.1.1 The description of the research sample

The data that is used in this study emerge from the five working-class schools in the Western Cape that currently are all participating in a university-based education research and development project. The five high schools are situated in the greater Cape Town area and the learners in these schools are predominantly ‘African’ and ‘coloured’ from working-class families.

The five schools are referred to as Schools P1, P2, P3, P6 and P7. Four of the schools have student populations comprising predominantly black ‘African’ children. Two of the schools are former apartheid era Department of Education and Training (DET) schools situated in the townships (P2, P3). These schools are close to the residential area of the communities that they serve. The school referred to as P6 is an ex-DET school situated in an affluent area in Cape Town. The school referred to as P1 is an apartheid era – House of Assembly (HoA) school with a student population from black ‘African’ and ‘coloured’ working-class families. The fifth school is a former apartheid era House of Representative (HoR) school with a learner population made up predominantly of ‘coloured’ children from working-class families

(P7). Most students that attend the last two schools come from townships and they travel long distances, either by bus or train, to get to the school.

The social class membership of students attending the five schools studied here is working-class and lower working-class. The schools are of similar type in terms of the social class background of the students they serve. However, there is no data that give details of the situation in the middle-class settings. Nonetheless, the purpose of this study is to develop the general methodological resources which are intended for use in the description and analysis of mathematics pedagogic practice in any educational context.

Methods used for capturing data are described in the next section.

4.1.2 Archive of information

4.1.2.1 Social organisation

The first component of the analytical framework is employed for interpreting data that was collected in the form of the interviews with the project fieldworkers, informal interviews with the teachers and classroom observation notes. All the informants were particularly interested in examining the various aspects that this study argues impact on the strategies teachers use for gathering information about their students' acquisition of criteria for the reproduction of pedagogic texts. In addition, these features are arguably a key for the structural effect of the pedagogic communication.

Interviews with the project fieldworkers

Fieldworkers spent a substantial time observing lessons in the five schools. They were then interviewed, mainly to give a general overview of what is happening in the classrooms of these five schools before the researcher visited the schools. The methodology of Dowling & Brown (2009) was used to structure the interview questions. To begin with, questions were asked about issues related to the contextual features of the pedagogic communication in each of the five schools. The researcher wanted to be acquainted with teacher-student ratios in the schools, classroom seating plans and the availability of resources such as the textbooks for students. These physical attributes are very important in any pedagogic situation because they determine spatial distribution (i.e. the part of the class that teachers were found in during the lessons, and also whether students had to share a limited space or whether they were seated comfortably at their own desks). The spatial distributions have implications for the type of social organisation of the participants involved in the pedagogic practice.

The researcher also tried to establish the general picture as to how the participants interacted in the classrooms (i.e. teacher-student interaction and student-student interaction). The status of students' discipline and the way in which the breach of conduct was dealt with, both in class and school as a whole, was also investigated. Finally, issues of time management in the schools in general, as well as for individual teachers, were investigated. These points are very important for marking out the prevailing social cohesion between the participants in different pedagogic contexts.

Informal interviews with the teachers

The main reason for carrying out informal interviews was to retrieve information which could not be easily obtained from the observations of lessons. For instance, information about the teachers' perceptions of their students, their views about their approach when teaching, and their feelings about the effect of the availability (or non-availability) of resources for organising the students in class were solicited. Other information that came from discussions with some teachers was about the schools' admission policy and their opinions on the functionality of the schools. This information is helpful for establishing what influenced various interactions in their respective classrooms. Lastly, the nationality of some teachers was established. This issue is important when considering the medium of instruction in the classrooms.

The observation of lessons

This archive of information provides the core of the data that focus on social organisation in five schools (*see appendix 2 – 6*). The lessons observed were chosen at random across all the grades (i.e. there were no restrictions for observing particular subjects or grades). This was in order to get an overall picture of the pedagogic practice as well as the factors that impact on it in each school. Bernstein's (1971) framing principles discussed in Chapter Three are used in order to organise information gathered from the classroom observations into their respective categories. A detailed account of this appears in the next section. The archive of data used specifically as evidence for the manner in which teachers evaluate students' acquisition of criteria is described below.

4.1.2.2 Evaluation

The second component of analytical framework deals with the data which emerge from the archive that was created in 2009 from the collection of video records and transcripts of

mathematics lessons and the observation notes of Grades 8, 9 and 10 lessons across five schools. Three consecutive lessons of a class were observed for each grade, and video recorded except for two classes where two lessons were observed (i.e. one double lesson and a single lesson). There were thus in total 43 videos and transcripts of lessons across the five schools. Two cameras were used to capture data, one focused on the teacher and the other on the activity of the learners. The video records were transcribed and, where necessary, translated from Xhosa and Afrikaans to English.

The primary data for this study, which focuses on evaluation with special reference to questions that teachers ask in classes, reside in the video-records of mathematics lessons and transcripts collected from Grade 9 classes in the five schools, each school constituting a single case. There are thus 13 lessons in total which are analysed using the framework that will be outlined later in this chapter (*see appendix 7*).

4.2 Analytical framework

The analysis, which is twofold, aims to generate data that make possible the articulation of informed statements about the social interactions in each of the five schools and the manner in which they impact on the teachers' strategies for gathering information about students' acquisition of criteria for the production and reproduction of mathematics texts. In other words, these frameworks outline aspects noticeable in classrooms that show whether pedagogy in each of the five schools was communalising, individualising or hybrid.

4.2.1 Framework on social organisation

The framework for data production, the central object of which comprises features that influence social interactions, is set out here. How each one of the features impacts on the interactions of the participants during pedagogic practice is shown with the help of the theoretical propositions discussed in Chapter Three. The framing principles with regards to both regulative and instructional discourses are equally important in shaping the pedagogic communication at the classroom level. Framing is used as the lens through which the conditions implicated in social interactions can be organised into their respective categories.

The information gathered in the classroom observation in terms of framing principles will now be categorised.

4.2.1.1 The configuration of categories for data production and analysis

The main principles of framing (regulative and instructional discourses) are used as the basic categories for data production and analysis. Regulative rules are here divided into the following interrelated components, namely, (1) contextual features, (2) social relations, and (3) the conditions for appropriate conduct. The contextual features are: classroom size, student population, the classroom seating arrangement, management of time and space allocated for each lesson and lastly, availability of teaching and learning resources. The social relations components are teacher-student interactions and student-student interactions in pedagogic situations. With regards to conditions for appropriate conduct, the status of students' discipline in the classrooms are examined, as well as the kind of disciplinary measures that teachers use for dealing with students who breach the school's rules.

In respect of instructional discourse, the extent to which teachers or students have control over framing of the selection, sequencing, pacing and evaluative criteria are assessed. Framing of pacing and evaluative criteria are also used to develop categories of teacher questions, which are discussed in the next section.

4.2.2 Framework on evaluation: teacher questioning

The relevant literature has revealed that questioning interactions are a significant part of mathematics teaching and learning in the classroom. Teacher questions are used both to facilitate teaching and learning, as well as, to evaluate the status of students' acquisition of criteria. Additionally, appropriate teacher questions may improve students' mathematical reasoning. In this section, a framework that is employed in the second part of data analysis, which is displayed in Chapter Six, is developed. The data comprising transcripts of mathematics lessons (*see appendix 7*) is described in terms of the types of questions that individual teachers ask per lesson and the kind of responses that students produce.

4.2.2.1 Description of teacher question

All the questions posed to students in the records of mathematics lessons are examined. This is contrary to the studies described in the literature survey in which only a few questions were selected and classified in terms of their 'cognitive level'. This is because all the questions and utterances are significant elements of pedagogic communication. Firstly, the questions are organised into categories by using the idea of an *ideal type*, which refers to 'the construction of certain elements of reality into a logically precise conception' (Weber, 1946: 59). What this means here is that questions with similar purposes are grouped into a single category, or

ideal type, and that questions having different purposes constitute different categories of question. The use of this method enables the researcher to locate distinct categories of questions that teachers use to evaluate students' acquisition of criteria which mark out what is considered to be legitimate knowledge in a pedagogic situation.

The first type of question, which shall be referred to as *interrogative questions*, consists of questions used to interrogate the state of students' acquisition of criteria. Such questions are beneficial for both teachers and their students. The teacher is able to recognise whether students have acquired the intended criteria for the reproduction of the mathematics contents. In other words, the teacher ascertains whether the students are reproducing the privileged text and are able to justify how they found the solutions to mathematical problems. The teacher can re-teach content that appears to be imperfectly understood by students. The teacher's interrogative questions can also assist students to recognise and correct their misconceptions. Interrogative questions are thus questions that have an individualising effect on students, producing information for the teacher on the state of an individual student's knowledge, and also enabling the students to confront their own inadequacies with respect to the content they are meant to learn. Interrogative responses attempt to elicit more complex responses from students.

A second category of question type is made up of questions that appear to be asked for the purpose of regulating the pace of a lesson, and are referred to as *pacing questions*. Such questions are aimed at the entire class rather than at individual students. The questions are apparently asked in order to alert students that the teacher intends to proceed to the next aspect of the content, or the next topic. The most frequent questions used in this category are: 'Do you understand?', 'Isn't it?', 'Are we together?', 'Do we all agree?', 'Are we happy about this?' The answers sought to a question of this nature appear to be either 'yes' or 'no'. Most often, however, students respond to this category of question with 'yes', but given that the student performance in tests and examination is poor, the 'yes' is less about informing the teacher about their states of knowledge, but more about public acknowledging that the teacher will move forward with the lesson.

The third category of questions is referred to as *statement completing questions*. Under this category, teachers ask straightforward questions to which students already know the answers, such as: 'What is two times two?' Or: 'What is two squared?' Such questions are asked by teachers as part of the elaboration of more extensive computations and the students' responses are used to complete the more complex transformations demanded by mathematical tasks. Included are questions that are in the form of sentences that are to be

completed in a more direct way, such as: ‘Eight times three is?’ The purpose of questions of this type, as with the former questions, appears to be to encourage students to contribute towards the production of solutions together with their teacher, even if only in a superficial manner. Usually students respond by chorusing the completion of the statement started by the teacher.

As indicated earlier, the information analysed is in the form of records of lessons of working class schools. The schools are referred to as schools P1, P2, P3, P6 and P7. As mentioned above, two of the classes observed had their three consecutive lessons in the form of a single lesson and two double lessons. All the questions posed to students in the video records of lessons as well as the kinds of responses they produce are examined.

4.2.2.2 Addressees of teachers’ questions

For every question asked by a teacher, it will be necessary to establish the identity of the addressee. Interest here lies in discerning when the teachers’ questions are addressed to individuals and when to groups of students, including the whole class as the largest group. Data of this kind is of interest because such data contribute significantly to the construction of descriptions of pedagogies as individualising and communalising.

4.2.2.3 Students’ responses to their teachers’ questions

The responses of students to questions can be a simple ‘yes’ or ‘no’ or silent. Responses that differ to the above mentioned are categorised as *extended* responses. Included in this category are the explanation and statement completing responses. Explanation responses come up when students are being prodded to do so by more interrogative questions from their teachers, but they often keep quiet when they are interrogated. Statement completing responses emerge in choral form, especially when students complete the statement initiated by the teacher, or when they give straight forward single word answers or when they respond to questions that demand more than single word responses. When students respond to questions in a chorus it is useful to check whether they respond homogeneously, or whether they offer more varied responses. If students are able to respond homogeneously, then it seems that questions are usually being addressed to the whole class and are of a type that requires only simple responses recognised by the majority of students. In those instances where students offer varying responses to fairly simple questions addressed to the whole class, it would seem that the student acquisition of criteria for reproducing the content is rather uncertain. An additional dimension of students’ responses to questions is the purpose of the response.

Responses that are not concerned with the lesson contents are thought of as falling under a single category, even though the specific purposes of such responses might be quite varied.

4.3 Validity and reliability of the study

Dowling & Brown (2010: 24) state that ‘validity concerns the relationship between theoretical concept variables and empirical indicator variables’. In the present study, I wish to be explicit about how the data is structured and analysed, and the way in which the theory and empirical data are put into conversation with each other. The empirical setting includes information about how social organisation impact interactions of participants in the classrooms. This is consistent with a Bernsteinian approach, which can be described as a sociological position. In the analysis, aspects of social organisation are found to be valid indicators of principles of framing.

Additionally, the validity of this work was enhanced by triangulating the results through carrying out interviews with research and development project fieldworkers and researchers, classroom observations and informal interviews with some teachers. These sources of data were found to be helpful to get insight about social organisation in the schools which appeared to be inadequately captured in primary source of data. The purpose of triangulation is to strengthen the analysis.

Nevertheless, validity is weakened by the fact that my research cases consist of five schools whose learners are all from working-class backgrounds, thus conclusions about relations between social solidarity and pedagogic practice in the context of middle class cannot be drawn. However this study does not aim to draw conclusions but to develop methodological resources which could be applied in other school settings.

As for Dowling & Brown (p. 24), ‘reliability is a measure of consistency of coding a process when carried out on different occasions and/or by different researchers. As a test for reliability, a researcher may produce instructions for coding a set of information’. Therefore in this study I use Weber’s (1949) idea of an *ideal type* to organise the questions in terms of their respective purposes. This method enables the researcher to locate distinct categories of questions that teachers use. Hence it can be used by different researchers in other pedagogic contexts for producing reliable data.

The framework outlined above is important for categorising information essential for addressing the research problem. The chapter that follows presents data analysis on social organisation.

Chapter 5

Data production and analysis regarding social organisation in the five schools

This chapter analyses data which was collected in the form of classroom observations in the five schools which form the sample of this study (*see appendices 2 – 6*). Different aspects of social organisations are categorised following the framework outlined in Chapter Four. The categories facilitate the interpretation of data. This part of analysis investigates how features of social organisation impacts on the interactions of the participants during pedagogic practice, as well as their importance in shaping the pedagogic communication at the classroom level. Tables 5.1, 5.2 and 5.3 summarise the findings on aspects of social organisations from each of the five schools. The results are discussed towards the end of this chapter.

5.1 Regulative discourse

5.1.1 Contextual features

Classroom size

The classrooms that were observed differed in size per each school. Sometimes the classroom sizes also differed within the same school, particularly in schools P2 and P6. Interestingly GET classes were allocated the smaller rooms, whereas the FET classes were taught in the fairly large rooms, yet there were more students at the GET classes than in the FET classes. As a result, the classes at the junior grades were heavily congested. In accordance with this, most project fieldworkers brought up similar concerns during the interviews.

Student population

Most classes in P1 and P7 were not overcrowded, and every student was comfortably seated in his/her own chair. There were about 40 students in the GET classes, whereas at the FET level, thirty was the average. In schools P2 and P6 classrooms were heavily congested, and the number of students ranged between 40 and 50. Similar statistics are confirmed by the information gathered from the project fieldworkers during the interviews.

Classroom seating arrangement

The seating arrangement in most classes at school P3, and some junior classes in school P6, followed a regular pattern. Small groups of students were clustered around two tables joined together, and were seated facing each other (as illustrated in Fig 5.1). In some other instances, some students joined two chairs so that three of them could sit together. The seating arrangement was permanent, and was not determined by the individual teachers' design of the lesson. This was also reported by most project fieldworkers during the interviews. It appeared that the seating arrangement of that kind prevented students from having clear sight of the board, specifically for those who seated at the right angles from the board.

In schools P1, P2 and P7, the classrooms were considerably larger. In those schools, except school P2, there was enough space between the desks to allow for free movement. In addition, the students had a perfect view of what the teachers wrote on the board. The general trend in most classes in schools P1, P2 and P7 was that the tables were arranged in rows facing forward (as shown in Fig. 5.2). In some classes at school P1, the desks were arranged in a horseshoe shape (i.e. the desks at the back were facing forward while those at the sides were facing in the opposite direction, leaving a large space at the centre of the classroom, see Fig. 5.3).

It was also noted that across the schools, students chose the seating position they preferred to occupy, perhaps with the intention of engaging in conversations with their friends without restraint. In schools P1 and P7, there were times that teachers moved students that were troublesome to the front desks.

Management of time and space allocated for each lesson

In each of the five schools there was a bell that signalled the start and the end of lessons. Schools P1 and P7 had a double bell system for regulating the periods. The first bell rang to alert students about the next lesson, and the second bell alerted students that they should already be seated in their classrooms, so that the teachers could begin the lessons. In all schools, except in school P7, the students as well as teachers were often not punctual. The same problem was also highlighted by the project fieldworkers.

In schools P3 and P7, the teachers mostly stayed in the classrooms while the students moved from one classroom to another. Both teachers and students in school P7 got into classes quite quickly, especially during the periods subsequent to the break interval. Similarly, the students

arrived punctually, even between the consecutive periods. In school P3 both teachers and students were usually late, particularly after the break interval. Students also arrived late in class between consecutive periods. It took 15 minutes on average before the lesson could begin, especially after a break. Teachers moved around in school P1 whenever they needed to use a specialised venue. Otherwise teachers stayed in their respective classrooms, whereas students moved around.

In schools P2 and P6 the usual practice was that students stayed in their permanent classrooms and it was the teachers who moved around. The average time lost between lessons was comparatively the same as in school P3, even though the reasons for that loss were quite different. The teachers in those schools happened to arrive late at classes, both after break interval and between lessons. The time lost between successive periods was mainly because after every lesson teachers went to the staffroom, most probably to fetch some materials that they would use in the next lesson.

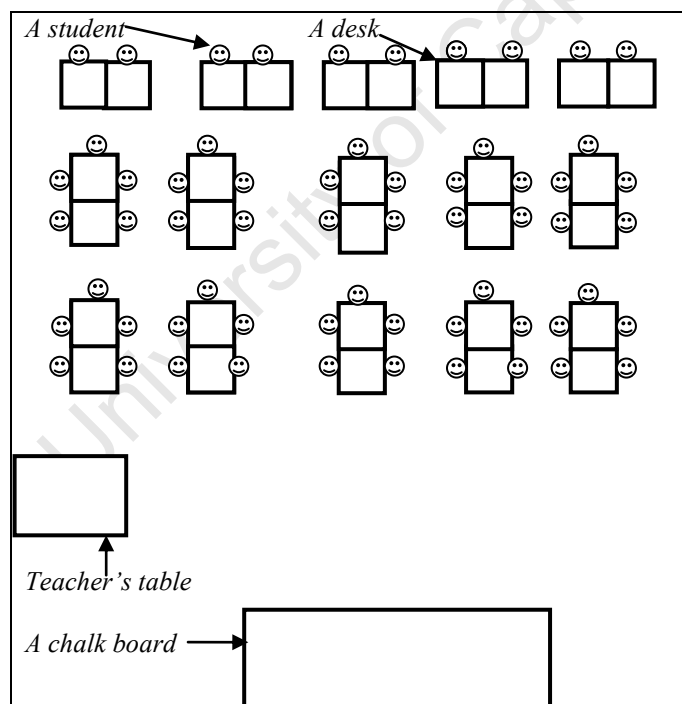


Figure 5.1: A seating plan in school P3 and some classes in school P6.

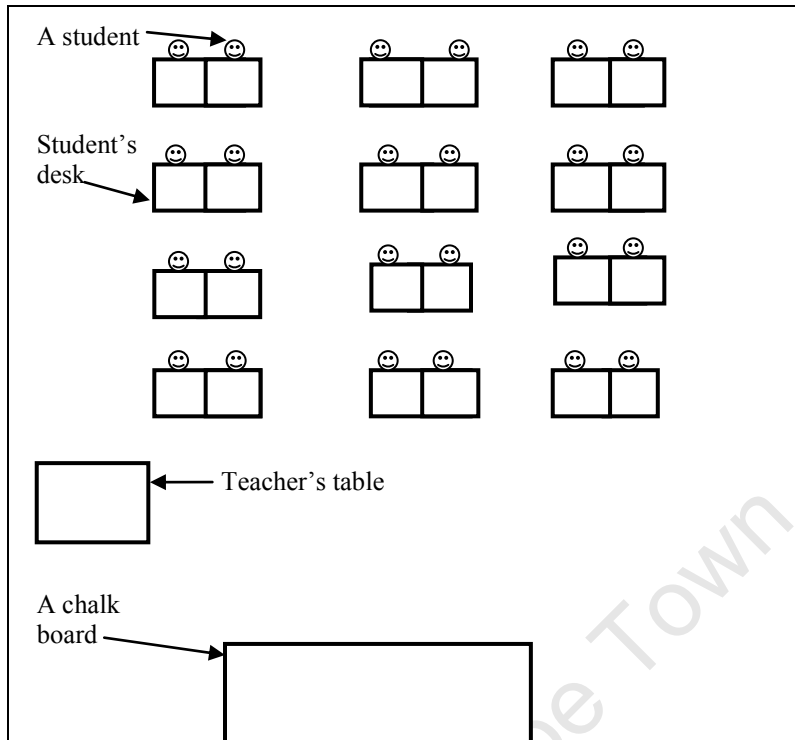


Figure 5.2: A seating plan in schools P1, P2, P7 and most classes in school P6.

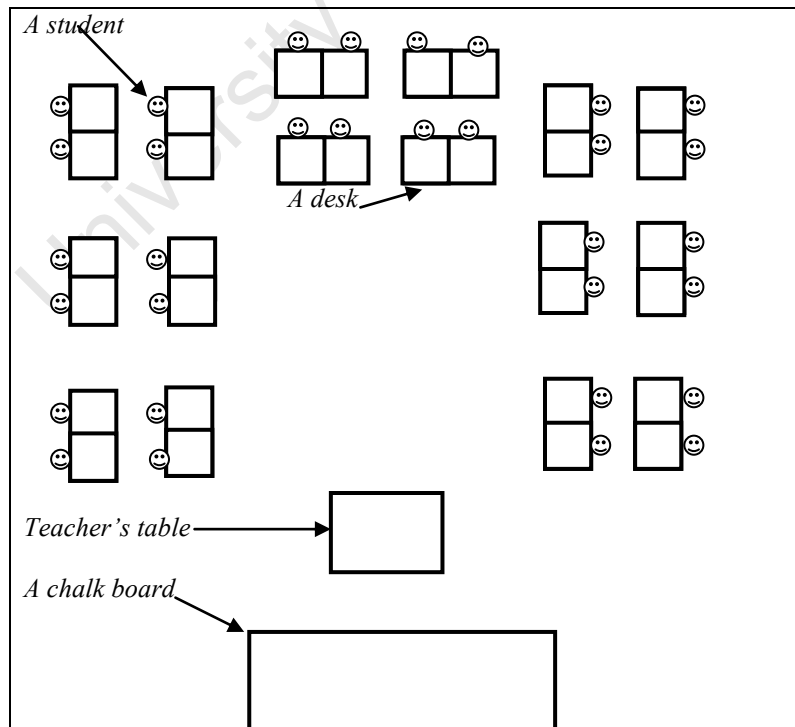


Figure 5.3: A seating in some classes observed in P1.

Availability of teaching and learning resources

In schools P1 and P7 there were specialised classes for teaching mathematics for both junior and senior grades. Those classrooms were equipped with overhead projectors. In schools P2 and P6, such facilities were meant to be used for teaching the senior students. In school P3, the science laboratory was used as a normal classroom and it appeared to be under-resourced.

Often some learning resources, such as textbooks, calculators, rulers and rubbers, were shared. When the teacher in school P1 wanted the students to do exercises in their textbooks, it appeared that only three students had textbooks and they had to share with those who had not brought theirs. Again, those who did not have textbooks and were not sitting next to those who brought theirs did not follow the lesson, but they were seen chatting with their peers. In fact, a shortage of equipment was evidenced in all schools except in P7, as there were no students seen throwing items such as pens and rubbers around.

Table 5.1: summarises contextual features evidenced in the five schools.

Schools	Classroom size	Student population	Seating arrangement	Management of space	Management of time	Teaching and learning resources
P1	Classrooms are fairly big	Not crowded	As shown in Fig. 5.2	Teachers moved around only for specialised classrooms, otherwise they stayed in their classrooms and students moved around	Teachers happened to arrive late at classes	A bit resourceful
P2	GET classes were allocated the smaller rooms	Overcrowded	As shown in Fig. 5.2	Students stayed in permanent classrooms	Teachers happened to arrive late at classes	A bit resourceful
P3	Classrooms are fairly big	Not crowded	As shown in Fig 5.1	Teachers stay in classrooms	Both teachers and students were usually late	Under-resourced
P6	GET classes were allocated the smaller rooms	Overcrowded	As shown in Fig 5.1	Students stayed in permanent classrooms	Teachers in those schools happened to arrive late at classes	A bit resourceful
P7	Classrooms are fairly big	Not crowded	As shown in Fig. 5.2	Teachers stayed in class	Both teachers and students got into classes quite quickly	Very resourceful

5.1.2 Hierarchical/interpersonal relations

Teacher-student interactions

Some teachers in schools P1, P6 and P7 routinely called students by name, especially when they invited them to work on the board. This was, however, not a general trend within each school. It was very rare for teachers in schools P2 and P3 to address students by name when dealing with content related matters. The teachers addressed individual students by their names only when there was a need to reprimand them. This practice was not unique to those schools, for it was seen in the three other schools. This suggests that teachers' obligations, as far as content delivery is concerned, were more to the community rather than to individuals.

In most lessons that were observed, teachers rarely moved from their position in front of the class. In schools P1, P6 and P7, some teachers moved around to check the books of students. They were, however, seldom seen marking them. On one occasion, a teacher at school P1 also asked a few individual students whom he interacted with about their progress as regards the assigned task. In some instances he was seen explaining some issues that were probably unclear to the students.

In one instance a school P7 teacher interacted with individual students. When the teacher asked a question some students tried to chorus the answer, but she stopped them immediately and requested them to put up their hands if they knew the answer. Afterwards, the students complied and the teacher chose one at random to give the answer. Seemingly, the teacher intended to engage as many students as possible. It appeared that the teacher moved around in order to identify the students who had finished solving a certain question. Once she came across an individual student who had finished doing the question, she immediately invited him/her to demonstrate the solution on the board. However, she did not give the rest of class enough time to finish solving the problem. The strategy that she employed gave the impression that she knew little about the work of the majority of the students, because she only checked the work of a few, while the work of the rest of class remained unchecked. She was also not seen marking students' work.

It was seldom that teachers made themselves available as resources for interrogation by the students, and even when they did, the students rarely utilised that opportunity. One teacher in school P7 asked students whether they understood what they had been taught. There was no response. She repeated the question and asked 'Who doesn't understand, so that I may help

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him/her?’ Again, no one responded. She asked that question on several occasions during the lesson. A teacher in school P3 used a similar approach and concluded the lesson by requesting students to write down questions that they wanted to ask so that she could address them in the next lesson. She made it clear, however, that when the exams commenced she would not entertain consultations.

Student-student interactions

On several occasions, students in most classes that were observed across the schools were seen helping each other to find the solutions, despite the fact that they were expected to work individually.

It was not easy to identify the presence of interactive participation and active involvement of the students in the lessons in terms of their gender and age. In school P7, however, it was boys who most actively participated in one of the classes. That happened when the teacher requested students to give their opinions on the ethical issues regarding their school rugby team when playing against a professional side.

The students’ reluctance to participate in the lessons could be due to the fact that they did not want to be humiliated before their fellow students. An example of humiliation took place when one student, as requested by the teacher, volunteered to stand in front of her classmates to read a passage in a handout. While she was reading, some students made irritating remarks and displayed no interest in listening to the passage she was reading. When she finished reading, some of her peers applauded very loudly, the motivation possibly being the destabilisation of the class.

In one school P3 Grade 10 class the students were seen throwing papers at each other, apparently in order to exchange messages with friends. However, in Grades 8 and 9, in the same school as well as in schools P1, P2 and P6, the students used those missiles as weapons directed especially at their classmates of opposite sex. An extreme case was witnessed in P1 when a girl threw a chair at a fellow student.

The students’ behaviour described here indicates that they were unable to recognise the clash between behaviour unacceptable in a classroom situation from that permissible out of it.

5.1.3 Conditions for appropriate conduct

Methods of maintaining discipline in the schools differed in terms of strictness. In schools P1 and P7 the proper wearing of the school uniform as a mark of identity was taken very seriously. Students were seen in their proper school uniform all the time. In schools P2, P3 and P6 the uniform was not strictly adhered to. In those schools, most students were seen in part of their uniform, but they were also wearing jerseys and jackets of different colours from that of the school uniform.

Control in school P7 was extremely formal and regulated by explicit rules that took into consideration the significance of time as a benchmark regulating all activities in the school. For example, before the lesson following the break interval could start, students were seen queuing outside the class waiting for the teacher to enter the classroom first. Only after the teacher had entered were they given permission to come in. When they entered the class the students remained standing and quiet until the teacher greeted them. In return, the students greeted the teacher. After that they sat down quietly. The same thing happened at the end of the lesson. When the bell rang signalling the end of a lesson, all the students stood up immediately. They remained standing until the teacher had greeted them, and gave them permission to leave. The students in each row made queues, when waiting for their row to be called out. When moving out of class, students did not crowd at the door, but the teacher controlled their movement by instructing the rows to leave in an orderly fashion. Moreover, individual students who were asked questions usually stood up before they could give answers. That routine was also witnessed in some classes in school P6. The students' considerate conduct in school P7 as well as in school P6, gave an impression that they generally realised the existing positional relations between themselves and their teachers.

There was no significant difference in all the schools in respect of the maintenance of discipline in the classroom during the lessons. Most teachers often used verbal intimidation when trying to control their classes. Despite this, some teachers were met with some resistance from students on several occasions. Usually teachers reprimanded the presumed offending student by shouting out her/his name. There were incidents in schools P1 and P3 where the reaction to a teacher's reprimand was defiance from the students. One occurred in school P3 when the teacher shouted the name of a girl who appeared to be the most notorious troublemaker in that class, to stop her from being disruptive. The girl shouted back at the teacher disrespectfully in Xhosa.

Then in school P1, when some boys were irritatingly rowdy, the teacher got annoyed and singled out one of the boys by name. She also exclaimed harshly that the boy lacked manners. The student wanted to shout back at the teacher, but was immediately stopped by his peers.

One teacher in school P3 did not take her positional relations with her students into account and her approach was ethically questionable. When she did not have matches for lighting a Bunsen burner she asked whether any of the students could come to her rescue. One student who appeared to be in his early twenties offered to lend her a lighter. Some students were full of admiration for their classmate. The teacher also joked that she did not have a problem using a lighter because she was once a smoker too. The students laughed in return. Another teacher took a quite different approach. When some students were laughing at the picture he was drawing and also making silly irritating remarks, he lost his temper and furiously shouted at the students saying that, 'at school I am your parent, and I deserve the same kind of respect that you give your parents at home'. They carried on regardless, ignoring his admonition. When the same class were taught by the different teacher that was presumably strict, the students were compliant. Similarly, the hierarchical relations between teachers and students differed in school P1, depending on the teacher who was in charge of the lesson. When one teacher was talking, students were inattentive. He kept on begging them to listen on a number of occasions during the lesson, but he was completely ignored. As a result his class was chaotic. The same students were obedient, however, when taught by a different teacher that was using a relatively conventional style of communication.

The poor control of students' discipline in some schools appeared to give students a great deal of freedom. They ignored their school responsibilities and engaged in activities that are not acceptable in school discourse. For instance, in school P1 when the teacher was moving around to check the students' work, he came across a group of students who were not tackling the task given to them. He was laughed at when he tried to talk to them. He did nothing to discipline those students. Other such incidents occurred when a girl was seen busy combing the hair of a boy in class, and also when a boy took out his lunch box and ate it together with a girl. On several other occasions, students were seen sitting together browsing their mobile phones instead of doing the school work.

The school had a double bell system, for regulating school periods. The first bell rang to alert students about the next lesson, whereas the second bell was for alerting students that they should

be seated in their classrooms, so that teachers could begin with the lessons. It appeared that the students ignored the first bell, especially the one which signalled the end of a break time. After the second bell had been rung, the majority of students would start going into their classrooms, but some continued playing, while others just loitered outside the classroom. On the whole the teachers were often not punctual, with the exception of one, but even then they had to wait for up to 15 minutes for the students to arrive. On their arrival the students did not settle down immediately. Even after the lesson had begun, sometimes for up to 20 minutes, some students would still be entering the classroom. Moreover, the students were often noisy during the lessons. Some threw pens at each other, ignoring the message on the wall exhorting them not to throw objects around. On some occasions, when the teachers were out, the students were very noisy. In all the cases stated here, the teachers did not take firm steps to reprimand the students, even when they witnessed the misconduct taking place.

Table 5.2: summarises hierarchical/interpersonal relations evidenced in the five schools.

Schools	Teacher-student interactions	Student-student interactions	Conditions for appropriate conduct
P1	Teachers called students by name, especially when they invited them to work on the board	<ul style="list-style-type: none"> • Students were seen throwing papers at each other directed at their classmates of opposite sex, especially in Grades 8 and 9. • Students were communicating in their home language. 	<ul style="list-style-type: none"> • Students were seen wearing school uniform properly • Some teachers were very lenient when dealing with students' improper conduct.
P2	It was very rare for teachers to address students by name when dealing with content related matters.	<ul style="list-style-type: none"> • Students were seen throwing papers at each other directed at their classmates of opposite sex, especially in Grades 8 and 9. • Students were communicating in their home language. 	<ul style="list-style-type: none"> • Most students were seen in part of their school uniform, but some students were seen wearing clothing that was not part of the uniform. • Some teachers were lenient when dealing with students' improper conduct.
P3	It was very rare for teachers to address students by name when dealing with content related matters.	<ul style="list-style-type: none"> • Students were seen throwing papers at each other directed at their classmates of opposite sex, especially in Grades 8 and 9. • Students were communicating in their home language. 	<ul style="list-style-type: none"> • Most students were seen in part of their school uniform, but some students were seen wearing clothing that was not part of the uniform. • Some teachers were lenient when dealing with students' improper conduct.
P6	Teachers called students by name, especially when they invited them to work on the board	<ul style="list-style-type: none"> • Students were seen throwing papers at each other directed at their classmates of opposite sex, especially in Grades 8 and 9. • Students were communicating in their home language. 	<ul style="list-style-type: none"> • Most students were seen in part of their school uniform, but some students were seen wearing clothing that was not part of the uniform. • Some teachers were lenient when dealing with students' improper conduct.
P7	Teachers called students by name, especially when they invited them to the board	<ul style="list-style-type: none"> • Students were not seen bullying each other. • Students were communicating in English among themselves. 	<ul style="list-style-type: none"> • Students were seen wearing school uniform properly • Control was extremely formal.

5.2 Instructional discourse

5.2.1 Selection and sequencing

As to the medium of instruction in the classrooms, teachers in schools P1, P7 and a few foreign teachers in school P3 communicated in English. Teachers in schools P2 and P6 and the majority of teachers in school P3, communicated in English but they often switched to Xhosa when they were explaining some ideas in the content. In one occasion, the teacher in school P3 communicated in Xhosa for the whole lesson. Xhosa was the home language of both the teachers and students in those schools.

In all other schools, except in school P7, students mostly communicated with one another in their home languages. In school P1 students communicated to one another either in Xhosa or in Afrikaans, but they used English whenever talking to the teachers. In schools P2, P3 and P6, the students communicated in Xhosa amongst themselves and even to the teachers, especially when they answered questions that required explanations. It was very rare to hear students communicating in Afrikaans in school P7, even though it was the home language of the majority of students and the teachers. English was the medium of communication that was widely used in that school.

A teacher in school P1 agreed to be interrogated but, even then, was selective as to the types of questions she would answer. For example, when one student showed her a mistake in what she wrote on the board, she corrected it quite quickly. However, when one student asked the teacher about something that appeared to be unrelated to content, teacher said she could not address that question, but was only ready to answer questions that focused on mathematics.

Teachers in each of the five schools appeared to have entire control over selection and sequencing of content.

5.2.2 Pacing

A scenario which was common in all the schools was that teachers often invited students to come to the board to demonstrate solutions to particular problems. The only difference that emerged, depending on the individual teacher's lesson, was the manner in which they dealt with each of the solutions that students displayed. Some teachers in school P1, P2 and P3 often dismissed a student whose solution was incorrect and requested the next student to come up and solve the

same problem. The same thing happened until one student got the correct answer. If all students failed to find the answer, the teacher solved the problem. Usually the teachers did not interrogate or guide students who struggled to find the answers as a way of helping them to think through the solutions that they had written down.

Some teachers in schools P6 and P7 requested students to come to the board to solve problems. There was an incident in school P6, where the teacher helped a student who was struggling to find the answer on the board. The teacher interrogated the student but the student appeared to be confused and decided to leave the board. The teacher asked the student to come back to make some corrections and guided him with questions until he got the correct solution. One teacher in school P7 often asked students to explain their work when they were working on the board. In some instances, when certain students were unable to answer a question correctly, she requested other students to get to the board to help their fellow classmates. She did not play an intervention role herself. On several occasions, immediately after one student who was invited to work on the board finished writing the answer, the teacher would often ask the whole class if the answer was correct. The usual response to that question was 'yes', even in some cases when the solution was incorrect. This was the case in all the schools.

In the case of school P6, the teacher slowed the pace of the lesson, but that appeared to be unhelpful to students. He called individual students by their names, requesting each one of them to answer the question he had asked. He realised that a few of them gave wrong answers, but he kept asking the same question to students who added up to about half of the class. He was hoping that they might ultimately get to the correct answer, but in vain. That seemed to consume much time. Despite that, he got the clear picture that most students had problems. Later on, he gave an explanation that probably enhanced students' understanding.

5.2.3 Evaluative criteria

Most teachers in schools P1, P2 and P3 were never seen marking students' books. One excuse that a school P2 mathematics teacher gave for not marking students' books was that he did not have a red pen. In those schools, teachers rarely interacted with individual students except in situations where there was a need to reprimand them. The latter was not unique to those schools, but also occurred in the other schools. In school P6 teachers were not necessarily marking students' books, but they were just writing signatures on those books.

In school P7 a teacher interacted with individual students when she was marking students' books. Of concern here was that she was only marking the work that she had given to students in the previous day, while students were working on the task that she had just given to them. It implies that the teacher blindly proceeded to the next topic without having evaluated the status of the students' knowledge acquisition of the previous one. The problem with that could be that the teacher might realise very late that the students did not understand what was taught previously. Additionally, the double-stranded problem might arise when the preceding topic could be a prerequisite, so obviously the one that followed it would not be understood.

5.3 Student participation in the lessons

The information pertaining to how teachers thought about students in relation to participation in the classrooms was gathered from an informal interview with one mathematics teacher in school P7. He indicated that most students often do not take responsibility for their learning. He added that the students only got serious about what to learn 'if it mattered', i.e. when it came to the scoring of good marks in the examinations. He said that if the teacher told them that 'this one is going to appear in the exam, 15 marks guaranteed', the students would put effort in trying to understand the problem and would be eager to consult their teachers. He also stated that in the midyear exam, students often do not show much interest in what they learn because they know that they could still pass if they can be focused towards the end of a year. Moreover, he pointed out that active participation as well as frequent consultations often occur towards the end of year examination, because students know very well that that examination determines whether they proceed to the next grade or not.

Table 5.3: summarises framing of instructional discourse manifested in the five schools.

Schools	Selection and sequencing	Pacing	Evaluative criteria	Student participation in the lessons
P1	<ul style="list-style-type: none"> • Teachers had overall control on selection and sequencing of content. • English was used as the medium of instruction in the classrooms. 	<ul style="list-style-type: none"> • Teachers often invited students to demonstrate solutions to particular problems on the board. • Some teachers often dismissed students whose solutions appeared to be incorrect 	Most teachers were not seen marking students' books.	Students usually do not actively participate during the lesson, except when they were invited to board.
P2	<ul style="list-style-type: none"> • Teachers had overall control on selection and sequencing of content. • Teachers communicated in English but they often switched to Xhosa when they were explaining some ideas in the content. 	<ul style="list-style-type: none"> • Teachers often invited students to demonstrate solutions to particular problems on the board. • Some teachers often dismissed students whose solutions appeared to be incorrect. 	Most teachers were never seen marking students' books.	Students usually do not actively participate during the lesson, except when they were invited to board.
P3	<ul style="list-style-type: none"> • Teachers had overall control on selection and sequencing of content. • Foreign teachers used English as the medium of instruction, the rest communicated with students in Xhosa. 	<ul style="list-style-type: none"> • Teachers often invited students to demonstrate solutions to particular problems on the board. • Some teachers often dismissed students whose solutions appeared to be incorrect 	Most teachers were never seen marking students' books	Students usually do not actively participate during the lesson, except when they were invited to board.
P6	<ul style="list-style-type: none"> • Teachers had overall control on selection and sequencing of content. • Teachers communicated in English but they often switched to Xhosa when they were explaining some ideas in the content. 	<ul style="list-style-type: none"> • Teachers often invited students to demonstrate solutions to particular problems on the board. • Teacher helped students who were struggling to find the answers at the board. 	Teachers were not necessarily marking students' books, but they were just writing signatures on those books	Students usually do not actively participate during lessons, except when they were invited to board.
P7	<ul style="list-style-type: none"> • Teachers had overall control on selection and sequencing of content. • English was used as the medium of instruction in the classrooms. 	<ul style="list-style-type: none"> • Teachers often invited students to demonstrate solutions to particular problems on the board. • Teacher requested students to explain their solutions. 	A teacher was seen marking students' books.	<ul style="list-style-type: none"> • In one class, boys actively participated during the lesson. • A perception of one teacher was that, students often consult teachers towards the end of year examination

5.4 Discussion of results on social organisation and pedagogic practice in the five schools

This section contains the discussion of results that focus on the aspects of social organisation and pedagogic practice in each of the five schools. The results show the influence of aspects of social organisation on the interactions of the pedagogic subjects, as well as the structural effect on the entire pedagogic communication.

To begin with, student population in each classroom appeared to influence the seating arrangement in the classrooms. The seating arrangement affected the teacher's interaction with the individual students during the lesson. The congestion and restrictions of space between the desks in most schools appeared to make it difficult for teachers to interact with individual students, especially in the junior classes. Nonetheless, in some schools where the seating plans allowed free movement, most teachers were not seen interacting with individual students. This shows that the seating arrangement sometimes do not affect teacher's interaction with the individual students. Hence one might well argue that teachers should be held responsible for failure to interact with the individual students during the lesson.

The management of time and space allocated for the lesson is very significant in teaching and learning. In fact, it determines the amount of content to be covered during the lesson. The majority of teachers and students in most schools often arrived late for classes. The evidence shows that in most schools when teachers had their own classrooms, students often arrived late. But teachers appeared to be rather lax in ensuring that students arrive on time for classes. Similarly, when students stayed in the permanent classrooms, some teachers reported late for classes. That kind of evidence cropped up from the interviews as well. That definitely compromised time for instruction. Based on the evidence, one could argue that aspects of social organisation play an insignificant role for upholding of students' discipline in class. When one considers the account of the teacher who ignored incidents of his students' indiscipline in class, it is evident that the teacher lost control and failed to take responsibility for what happens in the classroom.

The official medium of instruction was compromised in most schools. The majority of teachers used isiXhosa as a medium of instruction. Similarly, in some schools most students answered teachers' questions in isiXhosa, even when they were asked in English. In those schools the home language of both teachers and students was the same. Students communicated with one another and the teachers in their home language. However, in some schools the home

language of students did not affect the medium of instruction during the lessons. In those schools, students communicated with teachers in English. It should be noted, however, that aspects of social organisation could not play a role in the matter of the medium of instruction in the lessons, as this was something that the teachers decided upon.

It also seems reasonable to think that the perceptions teachers hold about their working environment influence the way in which they interact with students. The information gathered from the informal interviews with teachers and from classroom observations reinforced this view. One teacher recounted that her school lacks facilities and equipment for carrying out experiments. She indicated that the school has one science laboratory which is also used as a classroom. She said that if the facilities had been there, she could have divided students into groups and let them carry out the experiment on their own.

When one scrutinises the teachers' views, particularly their perception regarding the students' participation in the classroom, one would assume that some teachers share a sentiment that students only acquire content in preparation for the school examinations. This seems to agree with the selection of the work in the literature which indicates that teachers elaborate knowledge according to their perceptions of the ability of students. Even in a case like this, the aspects of social organisation in the classrooms play a minimal role for influencing interactions of pedagogic subjects. The results generally correlate with the information derived from the interviews with the project fieldworkers (*see appendix 1*). It has been established from the discussion that teachers are implicated in the social interactions of participants in classrooms. In fact, teachers are major role players in the facilitation of teaching and learning in pedagogic situations.

In consideration of social solidarity, the results show that there are both elements of mechanical and organic solidarity within and across the schools. Several examples reported above demonstrate *similar to* relations exhibiting mechanical solidarity. It has also been established that students at one school routinely performed their bounden responsibilities. For example, before the lesson could start, students were seen queuing outside waiting for a teacher to first enter the classroom. Only after the teacher had entered were they given permission to get inside. In the classroom, the students kept on standing and quiet until the teacher greeted them. After that they sat down quietly. At the end of a lesson, all the students stood up immediately then remained standing until the teacher greeted them and gave them permission to leave.

Chapter 5

Another example that showed *similar to* relations across the schools was the use of school uniform. As evidence of the importance of common identity, it has been reported that at some schools students who did not put their full school uniform were punished.

On the other hand, some examples that have been reported above show recognition of *difference*, which is an illustration of organic solidarity. Teachers across the schools specialised in the subjects that they were teaching. Another example that shows recognition of *difference* was the uncovering of misconduct. Some teachers singled out students who appeared to be misbehaving during pedagogic practice. In addition, students who appeared to be perpetrators were involved in fierce confrontations with teachers without hesitation. These few examples, show that an appeal to sameness can be prevalent in settings that gather together middle class agents; similarly, an appeal to difference – marking out of differences – in situations with working class agents. For Durkheim, as argued in Chapter Three, presence of one form of social solidarity translates to the absence of the other. This suggests that, the theory is flawed when one uses social solidarity in pedagogic situations for marking out social class differences.

The next chapter presents data analysis on evaluation, with reference to teacher questions and students' responses.

Chapter 6

Data analysis: Evaluation

This chapter is essentially intended to generate and analyse data concerning the strategies that teachers use for evaluating students' acquisition of criteria for the reproduction of pedagogic texts. As the central focus of this study is the investigation of the manner in which teachers use questioning to regulate pedagogic communication, the results derived from this analysis are aimed at addressing the research question. The analytical resources employed in this chapter are based on the framework developed in Chapter Four. The transcripts for each lesson were used to identify the questions posed by teachers. Each question was coded in terms of one of the three categories described in Chapter Four. In order to demonstrate the general trend for individual teacher's lessons as well as across the five schools, averages have been calculated in respect of the type of questions and nature of the student responses. The discussion of the results appears towards end of the chapter.

6.1 Outline of data production and analysis

In this study all the questions are categorised in terms of their purposes. Each question was coded in terms of one of the three categories. First category is the *interrogative questions*, which consists of questions used to interrogate the state of students' acquisition of criteria. Such questions enable a teacher to recognise whether students have acquired the intended criteria for the reproduction of the mathematics contents. Second category is the *pacing questions* and they are questions that appear to be asked for the purpose of regulating the pace of a lesson. The third category of questions is *statement completing questions*. The purpose of this type of questions appears to be to encourage students to contribute towards the production of solutions together with their teacher. Table 6.1 presents the total number of questions for each category of questions that teachers asked in their respective lessons. Table 6.2 provides a summary of the questions directed either at individual students or the entire class.

The study also examines the kind of students' responses to teacher questions, and the main categories are simple and *extended* responses. Table 6.3 summarises the types of answers that students provided when replying to the teachers' questions. Table 6.3 provides a summary of

students' responses to teachers' questions asked in the Grade 9 lessons across the five schools. Table 6.4 presents a summary of students' simple responses. Table 6.5 condenses the variations in students' simple responses into varied responses and homogeneous responses. Finally, Table 6.6 provides an analysis of the students' extended responses to teachers' questions.

6.2 The types of questions that teachers ask students and the intended addressees

Table 6.1. A count of the types of teacher questions used in lessons.

School	Lesson	Total no. of questions	Interrogative questions	%	Pacing questions	%	Statement completing questions	%
P1	1	154	46	30%	31	20%	77	50%
	2	120	22	18%	25	21%	73	61%
Average		137	34	24%	28	20.5 %	75	55.5%
P2	1	84	11	13%	27	32%	46	55%
	2	65	5	8%	26	40%	34	52%
	3	66	8	12%	14	21%	44	67%
Average		72	8	11%	22	31%	41	58%
P3	1	96	4	4%	39	41%	53	55%
	2	128	1	0.8%	48	37.5%	79	61.7 %
	3	4	0	0%	4	100%	0	0%
Average		76	2	1.6%	30	59.5%	44	38.9 %
P6	1	79	7	9%	27	34%	45	57%
	2	134	8	6%	48	36%	78	58%
Average		107	8	7.5%	38	35%	62	57.5%
P7	1	88	4	4.5%	42	47.75%	42	47.75%
	2	92	4	4%	29	32%	59	64%
	3	90	7	8%	37	41%	46	51%
Average		90	5	5.5%	36	40.25%	49	54.25%
Total average		96	11	10%	31	37%	54	53%

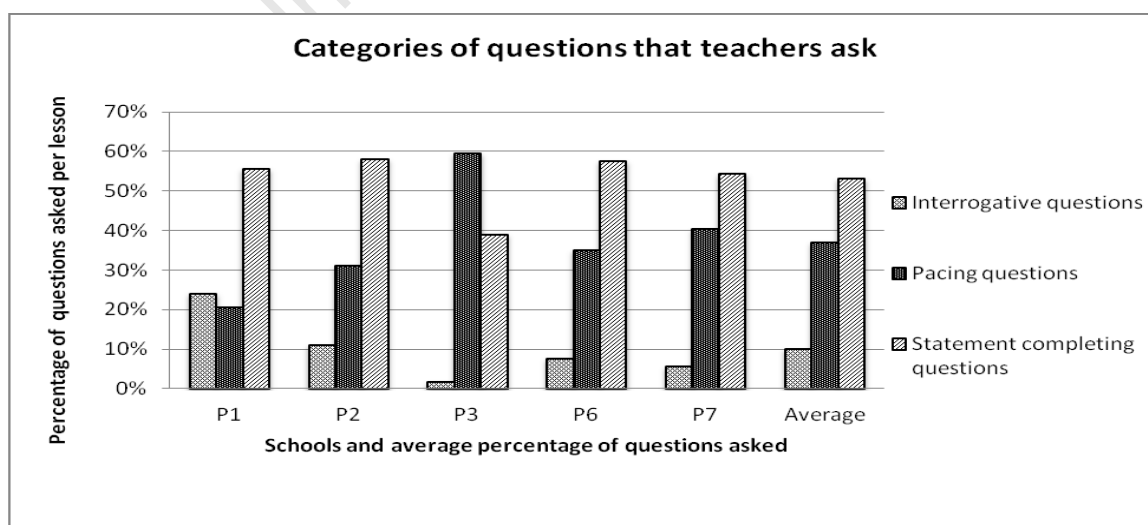


Figure 6.1. Comparison of different categories of questions in Grade 9 lessons per school.

Table 6.1 and Figure 6.1 show that completing questions are the most prevalent across all five schools, with an average of 53%. Pacing questions are the second most prevalent type of questions, with an average of 30%, whereas interrogative questions are the least prevalent type of questions, with an average of 10% asked.

Table 6.2. Summary of questions addressed to individual/groups of students.

School	Lesson	Total no. of questions asked	Questions addressed to the class	%	Questions addressed to individual students	%
P1	1	154	146	95%	8	5%
	2	120	108	90%	12	10%
Average		137	127	92.5%	10	7.5%
P2	1	84	77	92%	7	8%
	2	65	57	88%	8	12%
	3	66	62	94%	4	6%
Average		72	65	91%	6	9%
P3	1	96	93	97%	3	3%
	2	128	112	88%	16	12%
	3	4	4	100%	0	0%
Average		76	70	95%	6	5%
P6	1	79	71	90%	8	10%
	2	134	124	93%	10	7%
Average		107	98	92%	9	8%
P7	1	88	83	94%	5	6%
	2	92	88	95%	4	5%
	3	90	87	97%	3	3%
Average		90	86	95%	4	5%
Total average		96	89	93%	7	7%

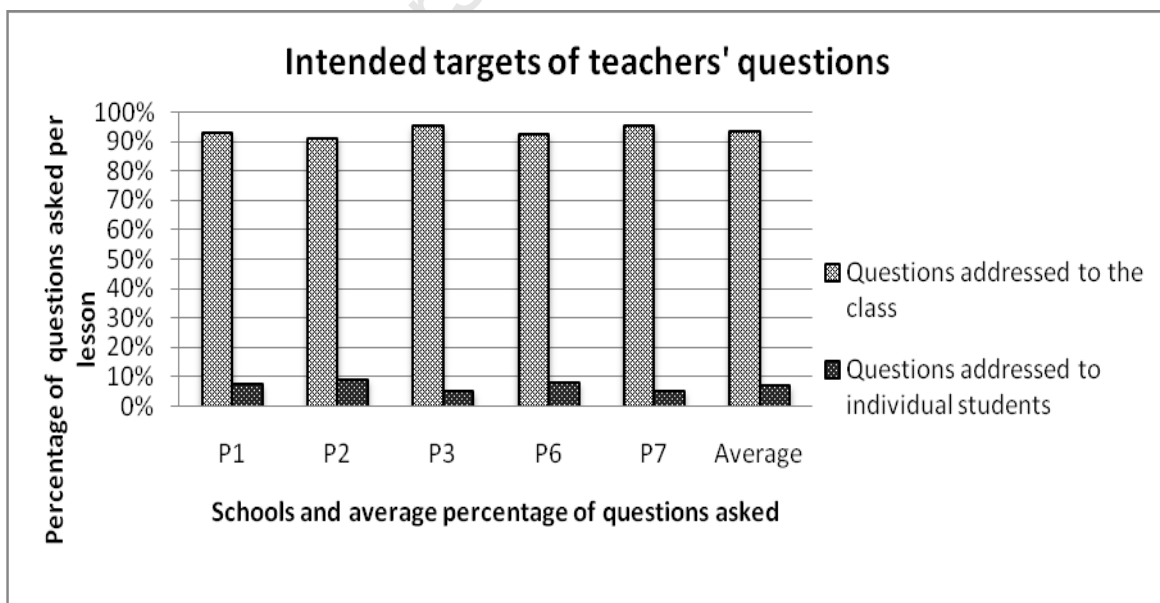


Figure 6.2. Comparison of the average number of questions directed at individual students and those directed at an entire class per school.

Table 6.2 and Figure 6.2 show that most questions (93%) asked in all five schools were directed at the entire class rather than at individual students.

6.3 Comparison of the types of students' responses to the questions that teachers ask

Students' responses were categorised in terms of the two main categories: simple and extended responses. Simple responses are further broken down into homogenous and varied responses, including (1) yes (2) no and (3) silent responses. The silence of the students was coded as a response in those instances when they failed to answer a question directed at them by their teacher. Homogenous responses emerge when students chorused an answer in unison to complete a phrase initiated by a teacher, while varied responses occurred when students gave different answers at the same time.

Table 6.3. Summary of the students' responses in lessons of five schools.

School	Lesson	Total responses	Yes	%	No	%	Silent	%	Extended responses	%
P1	1	83	11	13%	2	2%	4	5%	66	80%
	2	95	8	8%	1	1%	2	2%	84	88%
	Average	89	10	10.5%	2	1.5%	3	3.5%	75	84%
P2	1	56	20	36%	3	5%	1	2%	32	57%
	2	40	18	45%	2	5%	3	8%	17	43%
	3	61	8	13%	1	2%	2	3%	50	82%
Average	52	15	29%	2	4%	2	4%	33	63%	
P3	1	52	25	48%	3	6%	3	6%	21	40%
	2	62	17	27%	0	0%	3	5%	42	68%
	3	4	2	50%	0	0%	0	0%	2	50%
Average	39	15	38%	1	3%	2	5%	22	56%	
P6	1	69	23	33%	2	3%	9	13%	35	51%
	2	98	20	20%	7	7%	4	4%	67	75%
	Average	84	22	27%	5	5%	7	9%	51	61%
P7	1	71	17	24%	0	0%	2	3%	52	73%
	2	70	9	13%	1	1%	4	6%	56	80%
	3	84	17	20%	2	2%	3	4%	62	74%
Average	75	14	19%	1	1%	3	4%	57	76%	
Total average		68	15	22%	2	3%	3	4%	48	71%

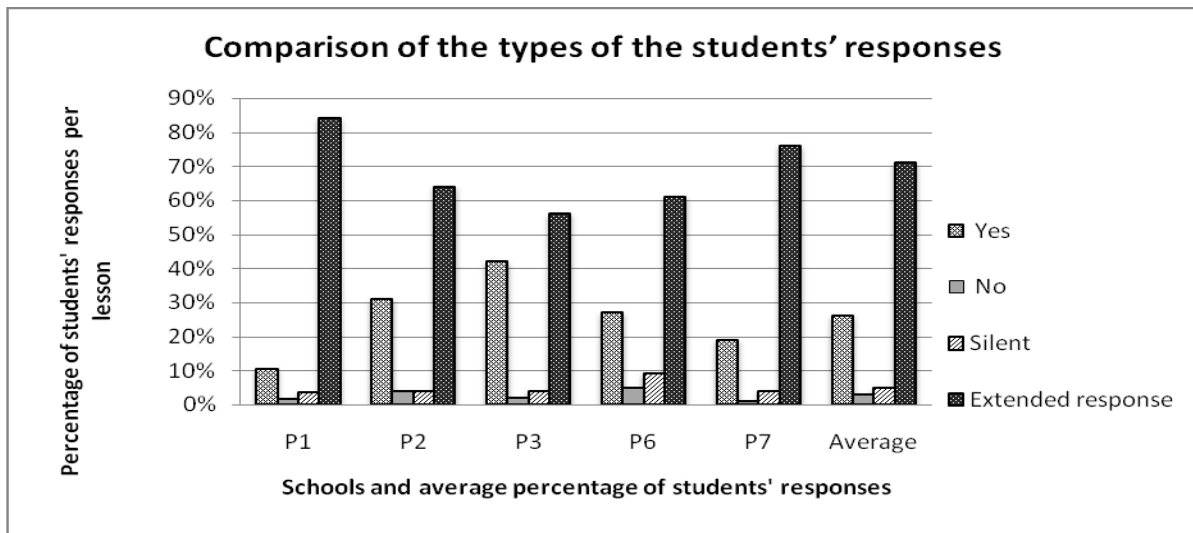


Figure 6.3. Comparison of the types of answers of students to teachers' questions.

Table 6.3 and Figure 6.3 show that extended responses appeared to be the most prevalent across the schools, with the overall average of 71%, followed by the 'yes' response with 22%. The least are the silent and 'no' responses with 4% and 3% respectively. The information provided here will now be broken down.

Table 6.4: Summary of the students' simple responses.

School	Lesson	Number of simple responses	Yes	%	No	%	Silent	%
P1	1	17	11	65%	2	12%	4	24%
	2	11	8	73%	1	9%	2	18%
Average		14	10	71%	2	14%	3	21%
P2	1	24	20	83%	3	13%	1	4%
	2	23	18	78%	2	9%	3	13%
	3	11	8	73%	1	9%	2	18%
Average		19	15	79%	2	13%	2	13%
P3	1	31	25	81%	3	10%	3	10%
	2	20	17	85%	0	0%	3	15%
	3	2	2	100%	0	0%	0	0
Average		18	15	83%	1	6%	2	11%
P6	1	34	23	68%	2	6%	9	26%
	2	31	20	65%	7	23%	4	13%
Average		33	22	67%	5	15%	7	21%
P7	1	19	17	89%	0	0%	2	11%
	2	14	9	64%	1	7%	4	29%
	3	22	17	77%	2	9%	3	14%
Average		18	14	78%	1	6%	3	17%
Total average		20	15	75%	2	10%	3	15%

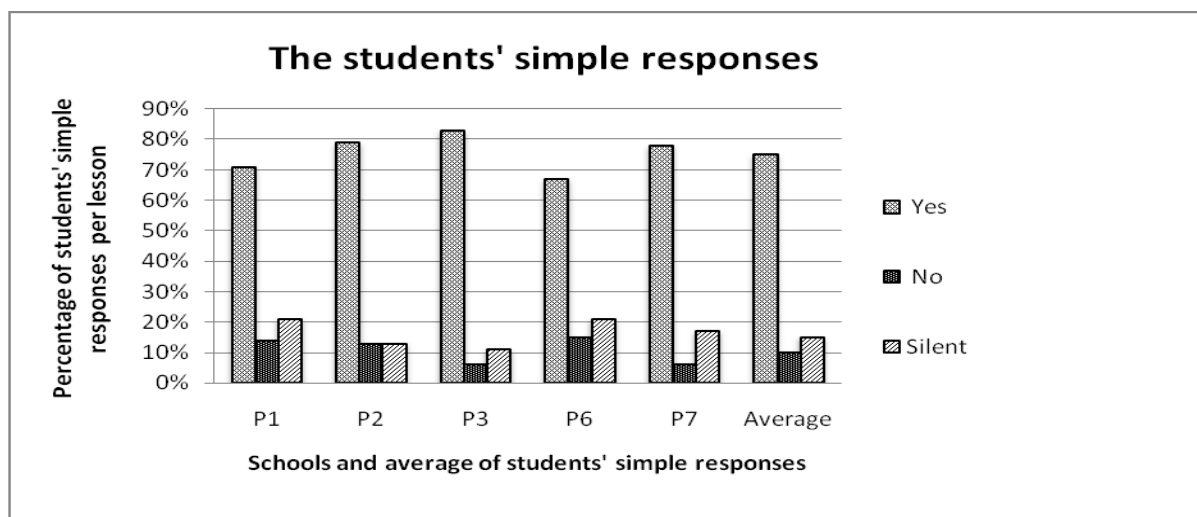


Figure 6.4. Comparison of types of students' simple responses to teachers' questions.

Table 6.4 and Figure 6.4 demonstrate that out of the total of simple responses the most prevalent across five schools was a 'yes', with the average of 75%, followed by silent responses with 15%, with the least being a 'no' with 10%.

Table 6.5. Summary of the variations in students' simple responses.

Schools	Lesson	Number of simple responses	Varied responses	%	Homogenous responses	%
P1	1	17	6	35%	11	65%
	2	11	7	64%	4	36%
Average		14	7	49.5%	7	50.5%
P2	1	24	1	4%	23	96%
	2	23	2	9%	21	91%
	3	11	3	27%	8	73%
Average		19	2	11%	17	89%
P3	1	31	0	0%	31	100%
	2	20	2	10%	18	90%
	3	2	0	0%	2	100%
Average		18	1	6%	17	94%
P6	1	34	5	15%	29	85%
	2	31	1	3%	30	97%
Average		33	3	9%	30	91%
P7	1	19	3	16%	16	84%
	2	14	6	43%	8	57%
	3	22	5	23%	17	77%
Average		18	7	39%	14	61%
Total average		20	4	20%	17	80%

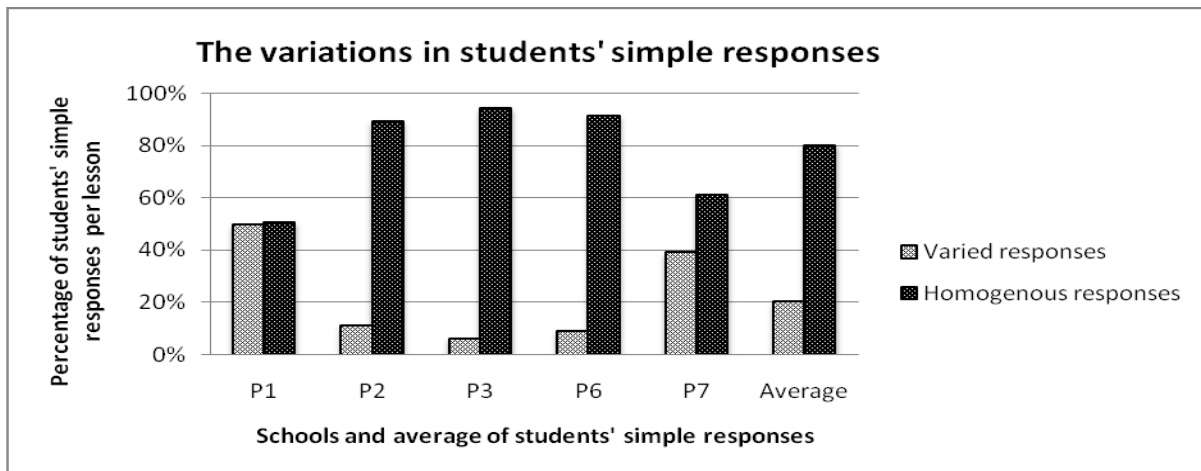


Figure 6.5. Comparison of students' varied and homogeneous responses to teachers' questions.

Table 6.5 and Figure 6.5 show that homogenous student responses are most prevalent, with an average of 80%, and that varied responses are least prevalent, with an average of 20%.

The second main category of students' responses (i.e. extended responses) comprises *statement completing*, *explanation* and *non-content based* responses. As indicated earlier, the extended responses of students emerged when students completed a sentence started by their teacher, when students tried to explain their work or some idea or process, and also in relation to things that had nothing to do with lesson content.

Table 6.6: An analysis of the students' extended responses to teachers' questions.

School	Lesson	Number of extended responses	Statement completing		Explanation		Non-content	
				%		%		%
P1	1	66	53	80%	13	20%	0	0%
	2	84	69	82%	9	11%	6	7%
Average		75	61	81%	11	15.5%	3	3.5%
P2	1	32	26	81%	4	13%	2	6%
	2	17	13	77%	0	0%	4	23%
	3	50	36	72%	8	16%	6	12%
Average		33	25	77%	4	10%	4	14%
P3	1	21	20	95%	0	0%	1	5%
	2	42	40	95%	0	0%	2	5%
	3	2	0	0%	1	50%	1	50%
Average		22	20	63%	0	17%	1	20%
P6	1	35	27	77.1%	8	22.8%	0	0%
	2	67	62	92.5%	5	7.4%	0	0%
Average		51	45	84.8%	7	15.1%	0	0%
P7	1	52	43	83%	1	2%	8	15%
	2	56	41	73%	9	16%	6	11%
	3	62	49	79%	5	8%	8	13%
Average		57	44	77%	5	9%	7	13%
Total average		48	39	81%	5	10%	3	6%

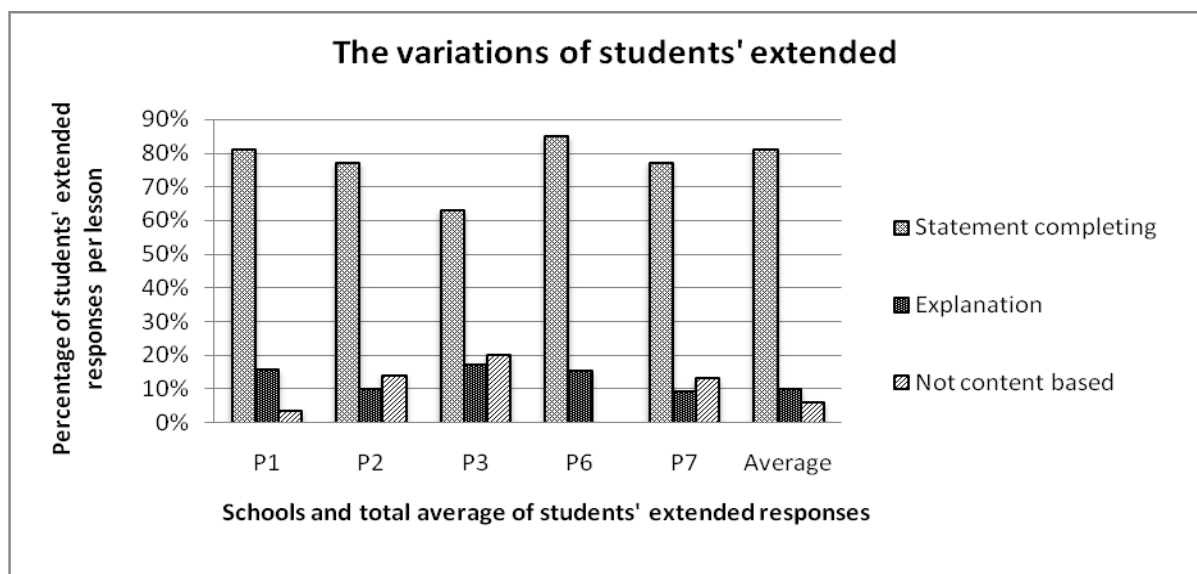


Figure 6.6. Comparison of the types of complex responses

Table 6.6 and Figure 6.6 show that *statement completing* responses dominate with an average of 77%. The least prevalent responses are *explanation* and *non-content based* responses, which occur 13% and 10% of the time respectively.

6.4 Discussion of results on evaluation

This section contains the discussion of results on the teacher questions and students' responses during pedagogic practice. The selected literature has shown that questioning interactions play a major role in facilitating pedagogic communication and also for evaluating the status of students' acquisition of criteria for the reproduction of mathematics texts.

The findings have revealed that on average, completing questions are the most prevalent across all five schools, followed by pacing questions, whereas interrogative questions are the least prevalent type of questions. Results also show that most questions asked in all five schools were directed at the entire class rather than at individual students. This type of questions that teachers often ask, appear to be of less relevance for gathering information about students' acquisition of mathematics content. Most importantly, the level of content acquired by individual students would hardly be recognised, since the questions were predominantly directed to the entire class.

The results demonstrate that on average *statement completing* responses dominate, the least prevalent responses are *explanation* and *non-content based* responses respectively. As it has been indicated earlier, the *statement completing* responses emerge when students complete a sentence started by their teacher. The results also show that in most cases the

students gave homogeneous responses rather than varied responses. Recall that homogenous responses often emerge when students chorus an answer to complete a phrase initiated by a teacher, while varied responses occur when students give different answers at the same time. The issue of choral responses was evident in the interviews with project fieldworkers. Choral responses do not give adequate feedback to the teacher about individual student's acquisition of criteria.

The findings have revealed that communalising pedagogic strategy was the most prevalent across the schools. Communalising pedagogy has implications on the transmission and acquisition of criteria for production of pedagogic texts. In general, teachers used communalising pedagogic strategies across five cases. One would argue that this approach provides teachers with meagre information about the level of students' acquisition of criteria. It also impacts on what is constituted as mathematics in the pedagogic texts that are produced by individual students. The extracts shown below exemplify the communalising pedagogic strategy employed by one Grade 9 teacher during mathematics lessons. The lesson was on the division of exponential expressions, and it was introduced as follows:

Teacher: ...the multiplication. Nê? {Right.} Today we going to do the division. Division. [Teacher writes /Division/ on the chalkboard] Any problems about yesterday's one?

Learners: No. [Learners reply in a chorus]

Teacher: Any problems about yesterday's one? The multiplication?

Learners: No problem. [Learners reply in a chorus]

[Extract from school P2 Lesson 1] (*See appendix 7*).

One would deduce that a teacher posed the same question twice as a way of alerting students that she intended to move on to division. As shown in the extract, students responded in a chorus, indicating that they understood everything concerning multiplication of exponential expressions. The teacher accepted students' response, and then proceeded to the next aspect of the topic, which was division of exponential expressions. After sometime, there were clear indications that the students had problems with multiplication of exponents, as shown in the extract below.

Teacher: Multiplication, what is the rule for multiplication when you are multiplying exponent?
Hmmm?

Learners: [Mumbled speech]

Teacher: And then 3 and then 4 minus two and here? Hmmm?

Learners: Plus one [Learners reply in a chorus]

Teacher: He bethuna! {People}then ngubani i-answer? {what the answer} Abantu ngoku abayazi kodwa sigale ngayo imultiplication. {People now do not know but we started with multiplication}

[Extract from School P2 Lesson 3]

Earlier on, there was no effort from the teacher to establish the actual status of acquisition of individual students concerning multiplication of exponents; but she only did that on the level of community. In fact, the communalising approach disregards the existence of individual differences among students. It provided the teacher with little or no data about the individual learners' problems regarding multiplication of exponents. Most importantly, communalising pedagogy has implications on what gets constituted as mathematics in the pedagogic texts that students produce. This manifests itself in the transcripts found in the appendices.

The results outlined demonstrate that, the general trend in the transmission and production of pedagogic texts was predisposed towards interdependence to the community in the part of students. However, a few teachers in some schools employed strategies which engaged individual students. In other occasions, teachers invited the individual students to the board. It appeared that some teachers were not aiming at testing individual students' acquisition of criteria or helping those who struggled to find correct solutions. This was realised when some teachers send away students who failed to get acceptable answers. The same thing occurred until the correct solution was found. In instances where students failed to find answers, teachers solved those problems. Apart from that, some teachers requested the students to put their hands up when they know an answer.

On the basis of results discussed above, it is evident that there were both elements of mechanical and organic solidarity in each of the five schools. Obviously, the communalising pedagogy exhibits the existence of mechanical solidarity. It is also apparent that there were elements of organic solidarity, when considering the instances where some teachers engaged individual students. As forms of social solidarity cannot coexist, it is inappropriate to apply this theory in pedagogic situations for justifying differences in terms of social class.

Now that results have been discussed, it is essential to return to the issue of relationship between social class, social solidarity and pedagogy. Generally, the views expressed in the literature chapter indicate that social class membership of students influences pedagogic practice. It is argued that teachers transmit mathematics criteria to students according to their social class background. It is also argued that social class also influences the teaching strategies that teachers use in different social class contexts. In addition, evidence from the relevant literature reveals that there is a possibility that social solidarity may influence the structuring of pedagogic communication.

As it was stated in the earlier chapters, pedagogic practice and social interactions have been dislocated from their relation to social class in this study. This study contends that evaluation is central to pedagogic practice at the classroom level. This is because it provides access to students the criteria for reproduction of mathematics texts. It also ensures acquisition of criteria regardless of students' social class membership. Teachers ought to ask questions that would establish the level of students' acquisition of content. They should also use students' responses as a feedback that would help in the development of intervention measures essential for students' learning.

In the analysis and the discussion outlined above, it is evident that there is inconsistency between social class, forms of social solidarity and pedagogy. Therefore, it does not seem reasonable to align social solidarity with social class and pedagogy in the manner that essentialises them. Therefore, it is incorrect to deploy social solidarity in pedagogic situations for justifying social class differences. It is also evident that the type of questions that teachers ask during lessons is related to the information they derive from those questions about the nature of criteria for the production of legitimate text. Relevant literature has revealed that questions guide learners to built mathematical reasoning. However, questions that teachers often asked across the five schools did not require mathematics reasoning from students. Therefore, the level of students' acquisition of criteria has implications on the constitution of mathematics in the pedagogic texts that students produce. The chapter that follows presents the concluding remarks.

Chapter 7

Conclusion

This chapter draws together the main points that cropped up in the entire report. It reflects on the results presented in Chapters 5 and 6 with the intention of addressing the research problem. It also draws together the major arguments presented in the literature and the major propositions derived in the theory chapter. Recall that this study is interested in examining ways in which the existence of criteria for the production of legitimate texts is judged by the teacher and how such relates to the forms of social solidarity. The chapter is concluded by stating the limitations and potential of my study.

7.1 Summary of results in relation to research problem

First of all, the discussion presented in Chapters 5 and 6 has shown that the use of social solidarity to explain social class differences of students in pedagogic situations is questionable. This suggests that, forms of social solidarity should be dislocated from class and pedagogy.

The results have demonstrated that aspects of social organisation in the schools have effect on the interactions of pedagogic subjects. In most schools, social organisation appeared to promote communalising pedagogy. Additionally, it has been established that teachers play a major role in the facilitation of teaching and learning. They usually do that through questioning interactions with the students. Nonetheless, the results have confirmed that the teaching approach followed in the schools across the five cases was mainly communalising, and it was practiced in the manner that effectively disregards the existence of individual differences among students. Hence teachers gathered little and unreliable data about individual students' acquisition of criteria for the reproduction of legitimate text. An acknowledgement of such differences is, however, central to teaching.

Alexander (2001: 356) points out that the 'two broad judgments that bear directly on children in schools and classrooms' are *differentiation* and *assessment*. By 'assessment' Alexander means what has been referred to in this study as evaluation. Alexander defines differentiation as 'the process of identifying differences in children as the basis of making decisions about where, what and how they should be taught'. In addition, he argues that, through assessment, teachers judge how and what children have learned, and 'feedback it provides forms the evidential basis for differentiation'. He concludes that the combination of

differentiation and assessment form the ‘continuum of educational judgment, overlapping within the teacher-pupil interactions that are at the kernel of teaching (p. 356).

As part of his study Alexander reports on the effective use of ‘whole class settings’ in primary schools in Russia, India, and French classrooms. He argues that effective use of ‘whole class settings’ was made possible by the kind of teacher-student interactions which entailed directing questions at specific students in a manner that the engagement was with the majority of pupils during a lesson (p. 364). Alongside such engagement, additional tasks were given to children who encountered difficulties in mathematics as a way of supporting them to catch up with their peers (p. 365). Teachers gave special attention to, and sacrificed their time for, the students who were identified as showing signs of low ability. According to Alexander, ‘if the teacher spends more time with one child than with another in a particular lesson this was because that child deserved to achieve no less than the one who was “better developed”’ (p. 365). This indicates that the teachers interacted with pupils according to their individual abilities. The results of his study show that, even though the pupils were not physically differentiated (i.e. in groups based on gender, age and ability), the pedagogic communication in those classrooms was highly individualising even while the primary form of engagement was with the whole class.

Alexander’s discussion shows that it is possible to use a ‘whole class setting’ efficiently by utilising interactions that get at the differences between students and which give teachers good data on students’ knowledge of the content during the lesson. Across the five cases that we have described and analysed here, the core of the problem is then not that of using whole class settings most of the time. Rather, the use of communalising pedagogy where teachers’ interrogations of students fail to deliver up much data on the state of knowledge acquired by individual students. Consequently, that appears to impact on what gets constituted as mathematics in the pedagogic texts that individual students produce.

7.2 Limitations and potential of my study

In this study, relations between social organisation and pedagogy were only explored in working class settings. It was not possible to explore the relations between social organisation and pedagogy in other settings because of the size of the project. Again, shortage of space meant that the study was not able to fully carry out triangulation. It would have been helpful to get students’ perspective as well that of the teachers, as the account of the informal interviews with some teachers has demonstrated. That would have reinforced the analysis,

particularly to get greater insight into the students' expectations about their teachers as well as the relationship between teachers' implied model learner and their pedagogical choices.

This study has focused on the micro-level of pedagogic practice in thirteen Grade 9 mathematics lessons at five working-class schools in the Western Cape Province of South Africa. Its aim was to produce a picture of the evaluative strategies employed by individual teachers in these schools. As the sample comprises working-class schools only, it would be misleading to draw the conclusion that the general picture which has emerged is as a result of students in the schools being from working-class backgrounds. At the moment, it is still unclear what picture would emerge in other contexts, and thus no comparisons in terms of social class can be made.

Nonetheless, the application as presented here of the methodological approach across schools in different classroom settings with students from different class backgrounds is essential in order to establish whether the social class of both students and teachers is implicated in the structuring of pedagogic communication as well as in influencing the strategies that the teachers use for gathering information about the level at which students acquired mathematics content. The main purpose of this study is to build on the previous work in mathematics education for the development of general methodological tools which could be useful for further research.

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Appendix 1

MSEP Mathematics researcher Interview (MR1)

Setsetso: what is the teacher-student ratio at the schools that you visited? Before I ask that question, which schools did you visited?

MR1: School P7 High in Michelles plain, School P3 in Phillipi, and School P1 in Mowbray, School P6 Secondary school in Mowbray as well and School P2 secondary school in Khayelisha Makhaza. The people ratio in classes is between 30 and 40 or 44. It depends, if you are dealing with matric class in mathematics, the numbers can be less. It depends on how matrics are doing maths. And you can divide that up.

Setsetso: How about in lower grades?

MR1: In the lower grades the classes can get quiet big. In School P7 they can be about 35. And I don't know about School P2 so, well I think they are about 40. In School P1 they are as well about 34, School P6 they are about not much more than that.

Setsetso: By the mere look of things were classrooms crowded?

MR1: You do get the crowded situations, you know. When I have done learner programmes, most students at once that I have worked with is 110.

Setsetso: Can you describe seating arrangement in the classrooms?

MR1: Sometimes mostly there are some desks, little tables and chairs, very often learners can be quite randomly seated in most schools. In schools like School P7 and School P1 they are much stricter in the seating arrangement. But you can get some situations, School P6 is quite organized. School P2 is a bit more chaotic in terms of you can get group of students clustered around one table. They are not often evenly distributed.

Setsetso: But under normal circumstances are students clustered in groups without being organized by the teachers?

MR1: I cannot say that is general because I have not observed a lot of classes. But certain teachers are more strict. I found that in School P1 and School P7. School P6 they are quite organized in the classrooms that I actually found out. But my experience in School P2 is a bit different. More like the learners decide and in School P3 maybe. I cannot be sure because mostly I have done learner programme where they have come to class for me.

Setsetso: Were students facing at the board or were they facing each other?

MR1: You do get that sometimes. Sometimes you enter classrooms and the chairs can be in different organization or like facing all around, facing the centre of classroom that's quite common as well.

Setsetso: How do teachers move about the classroom?

MR1: Very often teachers talk quite a lot and just towards the end they make a little bit of a look around. Mostly they stay at the front of the class.

Setsetso: You mean they mostly stand in front of the classroom?

MR1: Quite a lot. I think they are scared to see more of what learners are doing.

Setsetso: How was time allocated for instruction generally management by individual teachers?

MR1: There is often quite a bit of time lost at the beginning of the lesson, getting everything going, waiting for everybody to get seated. That's quite common.

Setsetso: What you mean is that students or teachers may come from other classrooms?

MR1: Taking the time to come to class. The teacher can also take the time to get going ... may be doing some adamant things sort out something in the beginning.

Setsetso: Does it mean that students were moving around the classes almost every period?

MR1: Yah mostly they move. In some schools, they definitely move they do not stay in one classroom. In School P7 they move.

Setsetso: Which schools do have such culture of students moving around?

MR1: School P7 moves, School P1 moves. I think School P6 also moves but not always. School P6 I am trying to remember but I am not sure because I had been there to teach the matrices.

Setsetso: How did teachers and the school in general dealt with the issue of late coming?

MR1: Schools have different systems. I don't think School P2 and School P3 are too strict. School P1 has like a counter setup where learners have to report as they arrive and explain why they are late. But I don't know what happens to them. In school P7 they are too strict, they have to report by the security if they are late.

Setsetso: How do teachers organize students when teaching, whether in a combination of large lecture groups or small group works?

MR1: Most of the teaching is the whole class lecture in most schools that I observed.

Setsetso: Did you ever notice teachers interacting with individual students?

MR1: Yah. Mostly it tends to happen around discipline. It happens too little in teaching.

Setsetso: What can you say about the relations between teacher and students? Are students free enough to interrogate a teacher about content?

MR1: No, not really. I think that the teacher tries to be seen to be doing their job as best as possible. But they very often ... they don't want to work too hard. They just want to do what they can, just to do the job in time. Learners are not encouraged to question.

Setsetso: Were there any instances where learners helped one another to produce the work that they were supposed to find answers individually?

MR1: They do help one another. Methods and answers are passed very quickly around the class.

Setsetso: Were there enough textbooks available for all students?

MR1: I don't think mostly there is often a shortage and learners in these schools often don't like to work on their own for their own pleasure. But they do it when they are forced to do it. So you don't see the text that much. Unless you teaching directly from them.

Setsetso: Were there instances where students were asked to answer the question on public space such as solving a problem on the board?

MR1: That happens sometimes.

Setsetso: How did teachers deal with the work that students produced, may be if the answer is incorrect?

MR1: I have seen instances where they haven't been properly corrected. But in other occasions they would correct them. So can't give one answer to that, it is a different answers to that question.

Setsetso: But looking at a general picture, do teachers interrogate students until they get the answer correct?

MR1: They often hand it to the learners to interrogate them, or to say what's wrong. They often tell them what is correct if they do not come up with the correct answer.

Setsetso: What about if the answer is correct, are they asked to explain how they obtained answer?

MR1: I haven't notice that.

Setsetso: What medium of instruction was generally used in the lessons?

MR1: Some teachers have small boards. They only have smart boards not black boards or white board. Other teachers have white boards, it depends on the class but teachers tend to have what suits them. There is a lack of space for mathematics working for most of the classrooms. Technology has reduced the space.

Setsetso: Can you say something about the language used in classrooms?

MR1: In most of the English speaking schools, it is English mostly. But in schools like School P2 and School P3 is partly English, but mostly isiXhosa like half of the explanation is in English. Just the questions are in English.

Setsetso: Other than school related duties, did teachers have other responsibilities?

MR1: Usually teachers have to be at school till 15:15. The tighter schools like School P7, I am sure there are duties that teachers have to attend. But I have noticed that in School P2 if its 15:15 people go home. At School P3 it depends on the time of the year. As it approaches the exams, teachers stay longer hours up until 16:00 to try to get the revision sessions. School P1 as well, they work until 15:30.

Setsetso: Were there any things like extramural activities?

MR1: Yah, they do have them. Certainly in School P7 and School P1 and in School P6 ... School P6 I only know about the choir. I haven't heard too much, but they do have sports at School P2 basket ball and things like that. I am not sure about School P6 and School P3.

Setsetso: As far as you can remember, did teachers direct questions to individual students or to the whole class?

MR1: Mostly, there is a tendency to direct them to the whole class, but discipline is more directed to the individual to keep people in their place.

Setsetso: What kind of students responses did you hear most frequently?

MR1: Learners who don't tend to stay quiet, and if everybody says yes they remain quiet. There is always a few individuals, in most of these classes handful of individuals that are actually interrogating the knowledge. But the majority is just going with the floor, and if the teacher expects them to respond, they would just say "Yes".

Setsetso: As far as you can remember did students abide by the rules and regulations of the school including that of wearing the school uniform and being punctual for the lessons? And if there was breach in discipline, how was that dealt with?

MR1: In schools like School P3, it seems like if learners don't have the uniform, they have to sort of come smartly, the boys have to wear jackets. But kids keep on coming with their ordinary clothes and sometimes they wear caps. That's what I have noticed. Most of them wear uniform. But the girls are mostly in uniform, but sometimes boys wear just ordinary clothes. In School P6 a uniform is a bit stricter, School P7 is also a bit strict, School P7 is like prison uniform, and they are strict there and School P1 is strict as well in uniform. But in School P2 and School P3 you would see pupils wearing something closer, may be they have given reasons for that.

Setsetso: Were there any corporal punishment imposed to the students?

MR1: In all the schools I have heard that there was a culture of corporal punishment. I have seen it almost at School P6 but I believe that they have stopped it. The teachers told me that they tried to stop it. But sometimes they give a little clap on ear.

Setsetso: Thank you so much for your corporation

MR1: You are welcome

MSEP mathematics researcher (MR2)

Setsetso: What is the teacher-student ratio in the classrooms of schools that you visited?

MR2: So you don't want to know the schools that I was to?

Setsetso: I would want to know that as well.

MR2: The only school that I had been to is School P6. And I went there in 2009 to observe the Grade 8 lessons, 9 and one of the first 10 lessons. I was also at the school subsequently as a supervisor for my PGCE students. So that was the only two occasions which I had been to the school.

Setsetso: So the school that you had been to is only School P6?

MR2: Yah, it was only School P6. I think teacher-pupil ratio varied depending on the ... so it was the general question about teacher ratio. It seemed in the classes that there were no subject choices it was close to 50 to 1. But that wasn't true for the more specialized classes. It was like at FET where there were subject choices I saw in one history lesson where there were six students present. So I don't know how to answer that question of teacher-students ratio. Because you can only ... I think what you are asking in general where there are no subject choices, on average how large was the class.

Setsetso: Yah. I am just interested only in Grade 8, 9 and 10.

MR2: But that was a Grade 10 where the class was very small. But in general classes seem to be between 40 and 50 that seems to be the size of class.

Setsetso: Can you describe the seating arrangement in the classrooms?

MR2: Well the desks were packed in rows if I remember correctly. Very close to each other, hardly space for the teacher to walk in between. The sizes of the classrooms are very small. I remember that the Grade 8 and 9 ... the Grade 8 class was like that very small and the desks were tightly packed together. But I have been in other classes where the desks were arranged in rows where there were spaces for the teacher to move. So sometimes it was the way in which the desks were arranged was tightly packed together, in other occasions they were arranged in rows for instance there would be 2 desks put together and another desks put together like that down in rows. So there is space here for the teacher to move around. So I have seen classes like that. So there isn't one arrangement, it varies depending on the size of classroom and number of the students in the class.

Setsetso: How did teachers move about the classroom?

MR2: Generally in front of the classroom. Occasionally teachers would move around the classroom when they were marking books, but really it was in a sense the signing of books. But when teaching they were generally standing in front at the board.

Setsetso: How was time allocated for instruction generally managed by individual teachers?

MR2: What do you mean by that?

Setsetso: Sometimes in other schools the lesson is allocated 45 minutes, but students have to move from one class to the next. Hence there might be time that is lost in between.

MR2: Yah. Definitely the children move and it seems like the teachers move. Some teachers have their own classrooms, but there are teachers who move as well, so the change over takes a bit of time.

Setsetso: How did individual teachers and the school in general deal with the issue of late coming?

MR2: Once I observed that they lock the gates at School P6. They lock the gates, and then the children if they are late they have to line about outside the gate until the teacher comes. I

have seen that on one occasion, the teacher comes and records the names. I don't know what gets done with that. Whether students are punished in anyway, but I have observed lessons where students come late into class. Round about in the first period while the class has started and there are some late comers and the teacher in the class doesn't do anything. They don't ask students for any slip or ... students are just admitted into the classroom.

Setsetso: The teacher doesn't say anything?

MR2: Yah, no questions.

Setsetso: How did teachers organize students when teaching?

MR2: What do you mean by that?

Setsetso: I mean whether the teacher organizes the students in a combination of large group lecture or into small group works.

MR2: Definitely like a lecture, teaching the whole class ... But like a lecture teaching the whole class. I didn't observe any group work being practiced.

Setsetso: Did you ever notice teachers interacting with individual students? If so, when did that happen?

MR2: I think there were occasions when teacher was moving while students were busy. And then this was in Grade 8 I observed. The teacher would check what they were doing and help them where they were going wrong and if they didn't understand it. But generally that didn't happen, that was rare.

Setsetso: What can you say about teacher-students relations, for example were students able to interrogate the teacher about content?

MR2: I think the students were free, but I don't know how you interpret that word free. There were very seldomly questions from students. I don't know whether you asking whether did students free or uncomfortable to ask questions or it is about established teaching and learning culture in the school in fact that the students never asked questions. They seldomly ask questions. It is mostly the teacher posing questions to the whole class. But I don't remember any instance where a student has asked the teacher a question.

Setsetso: Were there cases where students helped on another to produce work that they were supposed to produce individually?

MR2: They just worked on their own. I can't remember that. I don't actually remember.

Setsetso: Were there enough textbooks available for students?

MR2: The teacher was using the textbook in all the classes that I observed. The teachers appeared to be using textbooks for themselves but not really using the textbook with the students. In the Grade 10 class the teacher was giving them the homework task out of the textbook and I think students were sharing textbooks, if I remember well. But sharing textbooks doesn't mean they don't have textbooks but it could mean that students do not bring the textbooks to the school. In the Grade 9 classroom the teacher didn't a textbook at all, she was writing examples on the board. But she was using a textbook but the students were not, but it seemed like she was writing examples from the book. In Grade 8 class, he was using a textbook but I don't remember whether he was reading from that text at a certain point. But I am not sure whether students had textbooks but the teacher also wrote examples and exercises on the board.

Setsetso: What medium of instruction was generally used in the lessons?

MR2: English with isiXhosa. So mixed, switching from the one to the other. The children also tended to speak in isiXhosa speaking to the teacher.

Setsetso: Were there instances where students were asked to answer the questions on public space such as on the board? And how did teachers deal with their answers?

MR2: None of that sense where students had to do the work on the board. Was it in Grade 8 class, I can't remember if it was that lesson, but the teacher would get answers from the class and write that on the board. There were no instances that I can recall students coming on the board.

Setsetso: How did the teacher deal with such answers, for instance if they were wrong did the teacher interrogate a student until she gets it correct?

MR2: No, the teacher would just indicate that the answer is incorrect. So if it was the teaching of like the addition of integers, kinds of questions that a teacher would ask is "is it minus or is it plus" and the children would say "its minus" where it was supposed to be plus, the teacher would say, "minus?" and the children would realize that it is incorrect and they would say "plus". Even if it's a calculation error that the students have made he would indicate that the answer is wrong and wait until the correct answer emerges. Or if it doesn't he would explain it.

Setsetso: I think you already addressed this one. It says did teachers direct specific questions to individual students or they were directed to the whole class?

MR2: Mostly to the whole class.

Setsetso: What kind of students' responses did you most frequently?

MR2: Yes most frequently chorusing answers. Sometimes it would be the same answer and everybody says the same thing or sometimes a range of responses but coming in a chorus as a class. And the teacher often picks the answer that is a correct.

Setsetso: Other than their school related duties, did teachers have additional responsibilities??

MR2: I can't answer that question. I assume there are other responsibilities. It seems like the HODs are always out the class.

Setsetso: So you are not aware whether extramural activities?

MR2: No.

Setsetso: Did the students in the schools you visited abide by the rules and regulations of the school, including that of wearing school uniform and being punctual for the lessons?

MR2: No, there were some children who don't wear school uniform. But I don't know other rules of the school. As of the late coming it's very unclear how it has been addressed in the office. Teachers in the classrooms were not checking on it, they just allowed students to get into the class.

Setsetso: So you are not aware of whether corporal punishment was used?

MR2: I have heard of corporal punishment but I didn't observe it myself. But did find when I was doing my PGCE supervision, supervising students. There were times when my students were still teaching there was a noise outside indicating that there were classes that were unsupervised, either teachers were absent or teachers didn't turn up for a class. And these students were just outside making a lot of noise. So that is an indication that there is a breakdown in discipline in the school. There was too much noise that was disturbing to the teacher. You didn't ask about the state of the classrooms. I was going to tell you that the state of classrooms is not good to the extent that there are some holes in the floor. For the class which there is shortage of space no one can seat there, because there are holes at the floor. This also impacts on the movement of teachers around the class. This is a question about the resources. The classrooms are under resourced and there are no mathematics posters.

MSEP mathematics researcher (MR3)

Setsetso: Which MSEP schools did you visit or observe their lessons?

MR3: Over what period, any period?

Setsetso: May be starting from 2009 up to now

MR3: From 2009 I have worked at all five school but when we did the videoing of those lessons I was at School P2. So I did all the videoing at School P2. But here and there I observed lessons one or two at School P3. Perhaps with what is unrelated to the videoing, I observed other lessons in School P7 and then I have been in classes at School P1 quite often.

Setsetso: What was is student population in classrooms?

MR3: In School P2 I think, if I can recall they were round about 35 up to 40. School P3 was the same. I think generally the populations were in the region of 35 to 40 pupils.

Setsetso: What you mean is that there was crowding in classrooms?

MR3: In one or two classrooms depending on size of the venue you may have found two pupils perhaps seating next to each other. there was crowding. But generally everybody was in their own desks or tables. So the rooms were accommodating in that respect.

Setsetso: How did teachers move about the classroom?

MR3: At School P2, I think teachers generally moved around. The cases of Grade 8, 9 and 10 teachers at School P2 they basically moved all around the classroom. Sometimes to mark books, so they moved. At School P3 they tended to stay upfront, so it was just between the board and the first four desks. Very seldom, in the two-three lessons that I have seen there, did they move around the classroom. At School P1 the tendency was also to stay in front. And similarly at School P7, except for one teacher who moved about in the classroom to assist pupils.

Setsetso: How was time allocated for instruction generally managed by individual teachers?

MR3: I think generally poorly. But when you talk about instruction, there was I lot of time wastage. I have observed some of those things. I made notes about a particular lesson at School P1. It is probably in that paper that I wrote as well, which you can get all the details. But I think if one looks at it on average, in 40-45 minute period there is about 60% to 70% of the time as the average would be the time that they spent on some form of instruction.

Setsetso: How did individual teachers and the school in general dealt with the issue of late coming?

MR3: If I start at School P2, there was a practice rather disturbing practice. You would find that at about 10:30 to 11:00 o'clock some mornings, kids were looked out. And they would be lining out around the gate for that very long period of time. They were later allowed to move in, but I am not quite sure about what happens to them because I have never inquired. But there were times when I visited the schools at I arrive at 8:00 and I leave at about 11:00 and you find kids outside, at the time I leave they'll still be there. No intention of going anywhere. They would be waiting to come in. At School P3 generally, the kids properly dealt with very quickly and then they would be allowed in. At School P1 I never observed the situation of late coming and the kids being locked out, School P7 neither the case there. At School P6, although I never observed lessons there I picked up of something I remember this particular day when it was actually raining. And there were a huge number of kids waiting outside and they were made to stand in the rain. And the deputy principal was hanging around and did really scorn them and was shouting at them.

They were standing in this sort of rain at that particular time. I think it was also initially about a lock out period until they are let in to get into the classroom. I think it was in School P2 where there was this extended period of lockout.

Setsetso: How did teachers organize learners when teaching, whether in terms of combinations of large lecture group or small group work?

MR3: In the lessons that I observed there was never really any notion of group work. Generally it was a transmission from the teacher to the kids. Kids seating in the individual desks and the type of social organization at maybe was different. But generally, there wasn't much group work in the maths classes that I looked at. Everybody was basically seating on their own, not necessarily that they were working on their own. I think it was almost the teacher and this whole big group working in that sort of a way.

Setsetso: Have you ever noticed the teacher interacting with individual students?

MR3: They did, although they didn't do much group work. Teachers actually, quite a number of them walked around to interact with individual kids, whether it would be to mark books or whether it would be to reprimand. There was never much of a pedagogic interaction with regards to pupils' difficulties that they were experiencing with content. It was all about moving about ... you know, the practice of signing books and marking and moving maybe here and there having a bit of conversation with the kids.

Setsetso: What can you say about teacher-students relations? For example, were students free enough to interrogate students about content?

MR3: I think that generally, the teachers were amenable to that type of interaction. I think there were cases at those schools. The kids are never discouraged from asking questions. The type of questions or the type of engagement is perhaps another matter, but I think there was the opportunity for kids actually to pose questions.

Setsetso: But did they use that opportunity?

MR3: I don't think very effectively. When pupils didn't understand, generally the thing ... whatever was done, was explained again in the same way not a different form of explication. But it was just a repetition of what had been said before really.

Setsetso: What can you say about the relations of students among themselves? For example, do they share equipment such as rubbers, calculators and so on?

MR3: I suppose one should expect individual situations here. If I start at School P1, generally there wasn't a sharing of equipment. Kids would basically have their own things. Other relations at School P1 and other schools were the kids attempt to work together. The notion of working on their own was never been an issue. At School P3 there was some sharing and it might happen to kids who didn't have. But what I noticed at School P2 there was there was a lot of greater need for kids to share stuff, particularly things like a calculator, books and those things that generally they don't have. So it was a greater need there. School P7 well, I didn't note that because it was not important at the point or necessary for them to engage in that way.

Setsetso: Were textbooks generally available for all kids in the classrooms?

MR3: Textbooks were available. Whether they had them there at a given time that was another matter. So you may have found them sharing a textbook but it wasn't about the textbook being passed on. So the textbook would basically be between two pupils and so they move table or desks together so that they may share a book. But I think that the availability of resources, that those things were there, whether the teacher used them is another matter.

Setsetso: Were there any cases where students help each other to produce texts, which they actually expected to produce individually?

MR3: There was always ever many cases. I remember one teacher at School P2 Grade 10 she would often say this is individual work not class work, but you would always find that kids actually did work together. You'd have some cases where kids work on their own. But generally there is inclination for them to work together. In also School P2 in Grade 8 class, I don't know if it was by design, or because they actually use different venues for the different lessons in different days ... is that generally the arrangement of the desks was such that there was the sort of little groups that were seating facing each other. That was a general arrangement not the design like that of a lesson. Even though there was a group work specifically, when kids had to work on their own they would naturally shift into these grouped thing. Either some would and others would copy it down, but it was as a result of the way they were seating. At School P3 about the two classes that have seen there, all the desks were in rows facing forward and similarly at School P1 and School P7 that was a general trend. While kids were asked to work on their own, I think there was sharing of things as the activity unfolded.

Setsetso: What medium of instruction was generally used in the lessons?

MR3: Eh, for the lessons I observed, for most of them the medium of instruction was English. Particularly for lessons videoed. Although, in some of the schools teachers did switch to mother tongue instruction or I suppose for further explanation, or to give clarity or it was easy for them to explain. But at School P7, as a result of its demographics was just English, School P1 it is purely English. At School P3 and at School P6 and at School P7 rather School P2 you would have this switches to mother tongue. But generally it was English.

Setsetso: Other than their curricula related duties, do teachers have additional responsibilities?

MR3: Well I wouldn't eh ... when you are saying additional responsibilities, do you mean responsibilities outside the classroom?

Setsetso: Yah, extracurricular activities.

MR3: I think generally wouldn't be able to answer that one ... I would know that was the case in School P7. There were little more about that, there were teachers who have other engagement, whether they maybe sports engagements or cultural links. I cannot say much about the other schools. So yah ... I am not quite sure.

Setsetso: As far as you can remember, did teachers direct specific questions to individual students or were directed to the whole class?

MR3: I think generally if I were to sum it up, 90% class was the type of questions which were put the audience at large. On occasion and very rarely, were questions posed to the individuals. Obviously, what happened then is just that when the individual couldn't answer it was moved on to next person. There was no ongoing engagement for the teacher and the pupil, but generally it was a question put to the general audience.

Setsetso: What kind of student responses did you hear most frequently?

MR3: Most of them were choral answers ... except when the large majority didn't know the answer. Then you may have one or two kids who would know it, and you would hear single voice coming to the fore. So generally it was a form of choral answering.

Setsetso: Were there instances where students were asked to answer the question on public space such as solving a problem on the board? If yes how did teachers deal with the answers?

MR3: I think there were a bit of silly things. One, very seldom the pupil would go to the board, and would do a problem. There may be an error and the teacher may have interacted with that pupil in that way as an individual, but that was very rare. The general pattern when students went to the board there was collective ... communal way of answering ... of doing this problem. So if somebody made an error and couldn't satisfactorily justify what they were doing or why things were not working that person will be made to seat down and they call on somebody else. So you would have this team of people actually just getting to the answers.

Setsetso: Did students in the schools you visited abide by the rules and regulations of the school, including that of wearing school uniform and being punctual for the lessons?

MR3: Yah, I think generally the pattern was that there was school uniform for most kids ... or very-very close to school uniform. I didn't see any resemblance of the kids not wearing school uniform in those schools. And I suppose that sometimes with some cohesion they would tore the line and there might be some disciplinary problems in that particular respect. I think that for most ... one could conclude that in those schools they were doing that.

Setsetso: But if there was a breach in discipline how was that dealt with?

MR3: I didn't see much of this thing except for one incident at School P6, where as I have indicated with this late coming for example. Sometimes they were very aggressive tone from the deputy principal in that regard. But generally ... they were playing it down while I was there and that could be another matter, if it was in my absence I think it would be dealt with differently. So being an outsider as we are present it will be dealt with fairly okay.

MSEP Science researcher (SR1)

Setsetso: Which MSEP schools did you observe?

SR1: I have observed lessons at School P6, at School P7 and at School P3.

Setsetso: What was student population in the classrooms?

SR1: What do you mean by student population?

Setsetso: I mean is teacher-students ratio in the classrooms?

SR1: Okay. At School P6 I think they were on average at... I observed GET science and the sizes of classes were I think between 45 and 50. At School P3 I observed FET physical sciences and the classes ranged between I think 42 and 47. At School P7 I observed FET and GET science. And GET classes were also in the 40s, whereas in FET classes there was one class where there was only 17 learners and that was Grade 11 science. I think on average the physical science must be about between 20 and 30.

Setsetso: Was it the same in Grades 10 and 11?

SR1: Well I said in School P7 ... at School P3 I observed Grade 10 and that was between 42 and 47 and then at School P7 as I said I observed one class only and the average was between 20 and 30.

Setsetso: Can you describe the seating arrangement in the classrooms?

SR1: At School P6 in most classrooms they have individual tables with chairs and they are arranged in rows facing the front of the rooms. At School P3 the desks were arranged in groups where learners were facing each other. Although that was a seating arrangement, very little group work actually took place. At School P7 students also seat on tables facing in front.

Setsetso: How did teachers move about the classroom when teaching?

SR1: In most of the classes teachers were in the front of the classroom, in most of the time. There were few lessons at School P6 that I observed where teachers moved around to check what learners were doing. At School P3 the classrooms are very-very small and it is very difficult for the teacher to actually get to the back of the classrooms and I saw very little of that. Although there were some classes I observed in bigger rooms where teacher did on the other occasions ... actually moved around to check what the learners were doing. At School P7, most of the lessons would be directed from the front of the class by the teacher. And also on other occasions the teacher would move around the classroom, when learners were doing worksheets or something of that effect.

Setsetso: How was time generally managed by individual teachers?

SR1: Let me think. At School P6, in most of the lessons where the teacher was aware that I was going to come and observe and video the lesson teachers were on time and they use fully extend lesson. Although there were few occasions where the students were late and they delayed the start of the lesson. And there was one occasion I think where the teacher came late, but then what would happen is that teachers would extent the lesson by fewer minutes, which will then cut fewer minutes of the next period. At School P3 the teacher I observed was based in the classroom most of the time. The teachers were there and the students moved fairly quickly between the classes. The time was used by the teacher constructively, but learners were engaged with something fruitful in most of the time. At School P7 too, teachers were based in the classroom. Learners arrived fairly properly and a teacher was engaged in whatever they decided to do for most of the lesson. But what happens at School P7 is that 5 minutes before the end of a lesson or interval, there is intercom announcement. What happens is, as soon as that happens to students that signals

the end of a lesson. So there would be some start packing up when they hear that intercom announcement.

Setsetso: How did teachers organize students when teaching in terms of combination of large lecture group or small group work?

SR1: At School P6 all lessons except I think one ... I think three of them where it was completely teacher centred, where teacher stood in front of the class. And students sat on the desks and some of them were actually doing an activity on some worksheet or so. So there was very little group work. The lessons I observed where there was group work or science practical there ... students were working in groups there. At School P3, again besides the practical work which was done in groups, I think there was one lesson where I observed the teacher... where there was some group discussion. At School P7, I did not see any group work, besides one practical where learners work in groups.

Setsetso: What you mean is that as a science teacher, the practicals are carried out by the teachers or students themselves in their respective groups?

SR1: At School P6 I observed one teacher demonstration, where the teacher did the demonstration in front of the room. And the others had been hands on practicals where learners worked in groups following certain instructions. At School P3, the practicals were all for the purposes of formal assessment and again teachers gave instructions and learners then worked in groups. And at School P3 all those practical sessions were actually planned ... we actually planned those practicals with teachers, and sort of assisted them with the planning and the running of those practicals. Similarly at School P7 there were two lessons where the demonstration was done, again with our assistance. And then the other one was formal practical for assessment purposes again, which we assisted.

Setsetso: Did you ever notice teachers interacting with individual students? If so, when did that happen?

SR1: There is one on one interaction I suppose very limited. At School P6, some teachers do mention learners by their names and this interactions with some individual would be sort of questions-answer kind of interactions. So at School P6, it happens where teachers actually know the names of the students and direct questions at individual students. When the question is asked, students actually put up their hands and they are expected to answer. This is in two teachers that I observed and this is at Grade 8 level. And one of the other teachers I observed in Grade 9 class there you got more of communalized, where the teacher ask question and the whole class just gives an answer. So I saw some of that. At School P3, the teacher never accepted the communalized responses and she always asked individual students questions. She knew most of the students' names. At School P7, teachers would generally interact with individual students and naming them. But again this it was just question-answers type of interactions.

Setsetso: What can you say about the relations between the teacher and students? To be specific, do students feel free enough to interrogate the teacher about the content?

SR1: At School P7 in couple of lessons I observed, when a teacher made an error ... a content error, learners would put up their hands and actually ask. I witnessed the same thing at School P3 and the teacher in fact, when the child pointed out an error, she actually encouraged the rest of the class to also do so in future. At School P6 I don't remember any instance. There were errors made but no one actually ... either they didn't pick it up or the students didn't question it.

Setsetso: What can you say about the students' relations towards each other in the classrooms that you observed? Were students sharing the stuff as the rubbers, rulers, and so on?

SR1: At School P6, I think generally they do share. I think they get along quite well. However ... I am trying to think now ... I can't remember. Let me think about other schools. I think in all the schools children seem have fairly good relationship with each other. And what was interesting was also that the teachers hmm ... I am trying to think now ... the teachers if the student for instance answer the question correctly or they did problem correctly on the board the teacher actually encourage the rest of the class to applause them. So that kind of encouragement from the class was promoted by the teacher.

Setsetso: Were there any cases where students help each other to produce texts, which they actually expected to produce individually?

SR1: I am trying to think now ... Most of the lessons I observed students were taking notes from the board. Then when they were doing group work they would share information. But am not sure whether the teacher expected that to be individually written, or whether the expected the group effort.

Setsetso: Were there no instances where students were asked to do the individual exercises?

SR1: Ooh yes, they did give individual exercises actually. And in most cases the students sat on their own and did their work, but occasionally you would find them seating next to each other actually assisting each other.

Setsetso: Other than their curricula related duties, do teachers have additional responsibilities?

SR1: At School P6, yes they did. One of the teachers ... well some of the teachers I worked with were also Grade leaders, so that became the responsibility for the disciplinary issues all of that. One of the other teachers in School P6 was involved in many other extracurricular subject related activities. Some were subject related activities, projects for the other schools and so on. At School P3 the teachers I worked with as far as I know they were not involved in any other duties. Similarly, at School P7 teachers I worked with I am not aware of other activities that they may be involved in.

Setsetso: What medium of Instruction was used in the lessons?

SR1: At School P7 it is all in English. At School P3 it was all in English except for one lesson I observed which wasn't. And the reason, I think the other the other two teachers I worked with at School P3 why their lessons were in English, is because they were Zimbabwean teachers ... so all of their teaching is in English. But the South African teacher who I observed ... I only got to observe one of her lessons, she used isiXhosa.

Setsetso: Were there instances where students were asked to answer the question on public space such as writing something on the board?

SR1: Yes. I think in all the schools. I just think of School P7 ... I think in all the schools there were instances where the teacher called the students to the board.

Setsetso: How did teachers then deal with such answers? May be the answer was incorrect?

SR1: The teacher at School P7 I remember one instant where there was a mistake. And teacher then said to the learner "It's not quite correct" and asked someone else to come up, and then corrected. At School P3 I remember one incident where one learner made a mistake and the teacher actually went at the beginning of the physics problem and working through it. He got to show the students where the error was and then student could then proceed and complete the question correctly. At School P6 I can't remember any such incident.

Setsetso: How about if the answer is correct, do teachers maybe ask students to explain how they got an answer?

SR1: In most cases I think teachers don't ask them to elaborate further when it's correct.

Setsetso: Did the students in the schools you visited abide by the rules and regulations of the school, including that of wearing school uniform and being punctual for the lessons?

SR1: At School P3 I remember one incident where one of the teachers was obviously responsible for dress ... came into the classroom and checked the students and she caught one learner who was wearing a jersey which wasn't quite a school uniform. That was the only incident. So most of the learners wear school uniform, and that was one incidence where the child was actually asked to remove the jersey. Although after that incident, there were one or two students who were wearing different school uniform. At School P7, I think all learners wear school uniform, I don't remember any incidence. At School P6, again I think they all wear normal school uniform.

Setsetso: How about this of late coming?

SR1: Late coming? At School P6 the lessons in the first period of the day, they have major problem with the late coming. Across the school I know they are trying to address it now. But at School P6 the students are based in the classrooms and the teachers move. And so generally the student were there when the teacher arrives. At School P3, I think in the beginning of the day there is a problem with late coming. But after breaks students take a little bit longer to report to the class. But other than that they move fairly quickly between classes. At School P7, again I think the movement takes fairly quickly. The teachers do take a register at School P7. They are supposed to take a register at every class. At the other two schools I know at School P3 the teachers were expected to keep a register ... period register. Whereas at School P6, I didn't pick up whether they used a register. So, I think the movement is fairly quick. I know at School P7 what they have done recently is that there is a system of double bell. The bell rings at the end of a period and there is another bell which tells learners that they are supposed to be in the next classroom. The fact that the introduced the system, obviously, there must have been a problem with time.

Setsetso: How was the breach in discipline generally dealt with in the school.

SR1: As far as late coming was concerned, I am talking of the beginning of the day ... I think at one of the schools the students were not present were locked out of the school at beginning of the day and then they had to wait. And I am not sure what the follow up is after that. At another school, I witnessed the students being caned as they appeared at the gate. At another school they do have detention system for those who are late. In terms of homework and not doing the homework and so on, I know at the one school they had a detention system at some point. But it seemed to have fallen flat and teachers don't sent the students to detention for such kind of a thing anymore. I don't know if they still have detention system. For student who didn't do homework I didn't see any follow up, other than "why didn't you do your homework". I am not aware of any major breaches of discipline, except that at School P7. I was at the school one day, apparently there were some fights on the school premises and people from outside were involved. And I know that one student was immediately suspended. Other than that I am not aware of any other breaches of discipline.

Setsetso: I think that's all of the questions that I had. And thank very much.

SR1: It's a pleasure.

MSEP English researcher (ER1)

Setsetso: Which schools did you observe the lessons at?

ER1: Its School P2 and School P6.

Setsetso: For how long?

ER1: For quite some time. I started in 2008 but it was not MSEP, it was ZENEX but with MSEP we started last year.

Setsetso: How was the population in the classrooms?

ER1: Well, classes range from 40 to 56, 57.

Setsetso: For both schools?

ER1: For both schools, yah.

Setsetso: Can you describe the seating arrangement in the classrooms?

ER1: In some schools or in some classes learners are seated in double desks. That is two in a desk and in rows. Others are arranged in groups of four or groups of six.

Setsetso: Were classes big enough to accommodate those students?

ER1: They are not big enough to accommodate them but teachers try to accommodate them anyway because there is no other thing they could do. Like, the space is a problem it is sometimes difficult for the teacher to move in between desks because of the overcrowding in classrooms.

Setsetso: How was time allocated for instruction generally managed by individual teachers?

ER1: It ranges from teacher to teacher. Others manage it fairly well. Like when the bell rings teachers moves from one class straight to another, while some other teachers when the bell rings, they first go to the staffroom to fetch something, as they say. And they take about 10 to 15 minutes to get to class.

Setsetso: What about in those schools that learners move around?

ER1: No, in both schools its only teachers who are moving around.

Setsetso: How did teachers organize students when teaching whether in groups or just the combination of large group lecture?

ER1: They don't organize them, they just teach. It's like the way I already told you about the seating arrangement, if they are seated in groups then it is like that. Whether it is an individual teaching or group teaching, learners don't move around because of activities.

Setsetso: Did you ever notice teachers interacting with individual students? If so when did that happen?

ER1: Not really. They only interact with individual students when they reprimand them. But again I think, I assume it is because of the large numbers in the class. It is very difficult for them to give that individual attention.

Setsetso: What can you say about teacher-learners relations? Whether students are free enough to interrogate teachers about the content?

ER1: Well, what can I say? Learners are free to interact with teachers ... but look I have worked with Grade 8 and 9 and those are small kids. So they don't. If the teacher asks "Do you understand?" the chorus answer that you get is "yes", even if the learner doesn't understand. You don't find learners find learners who ask questions after the teacher has explained something, or a learner who say I don't understand this and that. So well, the only interaction that is there is the one where like they sing a song, they say the same things at the same time. That is the kind of interaction that you will always find in schools.

Setsetso: What can you say about student relations amongst themselves?

ER1: I haven't noticed any what, hmm... I can say they relate well with one another, because I haven't noticed any fightings and any things like those.

Setsetso: Did you notice them sharing any equipment?

ER1: Not really, because with English it is not like Maths where they use pencils and calculators and all that. With English, it is just a book and a pen. So haven't noticed or observed it.

Setsetso: Were there cases where students helped on another to produce work that they were supposed to produce individually?

ER1: Not that I can think of. Do you say when individuals are writing in their books?

Setsetso: Yes I mean that. When they are given an exercise to write, then you see the teacher expects them to do work individually but you find one copying from another.

ER1: I didn't notice that.

Setsetso: Were the textbooks enough for all students?

ER1: The two schools that I work with do not use textbooks. With School P2 they are using a short story book and each learner has a copy. With School P6, they are using a novel and the learners don't have copies. The teacher must first make copies of chapters, like chapter 3 or chapter 4, if that is what he wants to cover for the term and he gives them to learners. Learners don't have their own copies. The only copies that they have are only photocopied copies.

Setsetso: Even those at School P2 bring their books all the time? They don't tend to forget them at home?

ER1: No.

Setsetso: What medium of instruction was generally used in the lessons?

ER1: It is English. But, sometimes look... I have only being in schools twice a week. Sometimes you would feel that well the teacher uses English because I am around. And you pick that up from response of the learners. You can see that the way they respond is not something they are used to. But there are teachers who use English right through.

Setsetso: As far as you can remember, did teachers direct specific questions to individual students or they were directed to the whole class?

ER1: Mostly they were directed to the whole class. It is very rare to find teachers directing questions to specific students. It is very rare.

Setsetso: So what type of students' responses did you hear mostly?

ER1: The chorusing.

Setsetso: Other than their curricula related duties did teachers have additional responsibilities?

ER: I am not sure of that because I am only there for classes. After classes I leave after the classes and I don't know what happens after classes.

Setsetso: As far as you can remember did students abide by the rules and regulations of the school including that of wearing the school uniform and being punctual for the lessons?

ER1: Yes they do. In both schools, if they are late they are locked out of the gates. So they know that they should come early. Like School P2 if students are late ... the gates are locked at... classes start at 8:00 and the gate is locked at 8:10. So if learners are late, they stay there until 11:15, which is lunch. So they know that they should come early to school. And in both schools, they do wear school uniform and they do abide by the rules.

Setsetso: What you mean is that those who are being locked out miss out, and the lesson just continues?

ER1: Yah , they miss out about four lessons, because before the break its about four periods. So they miss out four lessons when the learner is late.

Setsetso: So how may be the teachers make arrangement for those students?

ER1: I don't think they do, I don't think they make arrangements for them. I don't think they go back because two or three learners were late. I don't know how they... I have never noticed, but I don't think they do.

Setsetso: Do you think that kind of punishment is the only one, which is locking the gate and there after learners are free to enter the classrooms?

ER1: I think so. I don't know about School P6. I think School P6 calls parents in but I am not sure didn't follow that up. But in School P2 it is just that locking of the gate that is it yah.

Setsetso: Were there instances where teachers asked students to do the some work on the board?

ER1: Yes they do ask learners. Like for example, if in English they are doing summary writing, they would ask one learner to write the first point on the board.

Setsetso: So if what they are expected to write on the board is wrong, how do teachers deal with that?

ER1: The teacher asks from class, "Is it correct?" and the class would say "No" if it was wrong. And the will ask "Who can correct it?"

Setsetso: So the teacher doesn't interrogate the learner.

ER1: No, the learner writes his answer and finishes it and goes back to take his or her sit. Then the teacher would ask "Is it correct?" the learners would say, "No". One learner will raise his hand up to correct that mistake made by that learner.

Setsetso: If the answer is correct?

ER1: They would say "yes".

Setsetso: So there is no further interrogation?

ER1: Yes. Unless the teacher sees that it is wrong. Although learners might say it is correct while it is wrong. Then the teacher will try to point them to where it is wrong. And then she or he will ask them to correct the mistake.

Setsetso: Actually I am interested to whether the teacher interrogates to explain how she got to the answer.

ER1: No. again as I said, this is different from Maths. Like if the learner is asked to change a statement into indirect speech, I think the teacher assumes that they all know the rules of indirect speech. It's only when the learner forgets to change a verb into past tense or past participle. That is when the teacher asks if that is correct from the whole class. But he doesn't ask the learner who came with an answer as to how you came up to that answer, no.

Setsetso: Thank you so much, we are now done with our interview.

ER1: Okay.

MSEP English researcher (ER2)

Setsetso: Which schools did you observe lessons at?

ER2: At the moment I am working at School P3.

Setsetso: What about previously?

ER2: Previously I worked at School P2 as well as School P6 and School P3. That's three MSEP schools in which the kids are isiXhosa speaking but where the language of learning and teaching is English.

Setsetso: What is the teacher-students ratio in classrooms?

ER2: The Grades 8 and 9 classes generally are the bigger classes and it's on average about 55 to 59 learners per class. Grade 9 is around about 50s at School P3.

Setsetso: What about in other schools?

ER2: That's also the classes are very large. Because we mainly worked... in MSEP we only worked at GET level, I can only speak about those classes. That's what the averages are.

Setsetso: Can you describe the seating arrangement in the classrooms?

ER2: Generally the kids are seated in straight rows. But you have observed at School P3 for some strange reason they have Grade 8 smallest classes and there have been single tables which are arranged in double rows. So the learners face each other. It doesn't necessarily constitute any arrangement for group work. It was done in order to fit in all the desks into the classroom. But it is very awkward for the learners to even observe what is going on on the board.

Setsetso: How did teachers move about the classroom?

ER2: With great difficulty. Most teachers don't really move around the classroom. What I have noticed in the classrooms, that are occupied by Grade 9s is that they do have... there seems to be more space. Because the desks are arranged in groups so it is easy for the teacher to move around in the classroom.

Setsetso: How was time allocated for instruction generally managed by individual teachers?

ER2: Not very well. Look they have 45 minutes per the period. Some teachers are very good at being at the class property before the start of the lesson. There are a few teachers who seem not to... but this probably relates to classroom management. They struggle to get the kids to settle down. So generally there ... I would say on average there is about 10 minutes that is wasted at the start of each period.

Setsetso: How did teachers organize students when teaching, whether on the bases of the combination of large lecture group or in small group works?

ER2: Generally it's the whole class teaching.

Setsetso: Did you ever notice students interacting with individual students? If so when did that happen?

ER2: The interaction with individual students normally takes place when teachers are reprimanding learners. And occasionally when teachers are going around and marking learners' work.

Setsetso: What can you say about teacher-students relations, for example were able students to interrogate the teacher about content?

ER2: Generally what I found is that the learners don't ask a lot of questions. The only person asking questions is certainly the teacher. If there is obvious mistake made by a teacher they will alert the teacher to the mistake. But generally teachers don't encourage learners to question. And in fact I have noticed even with the kinds of questions that they ask the

learners are more often than not for general retrieval. It's not the kind of "What do you think?" or "Why do you say that?" "What if?" questions... No open ended questions.

Setsetso: What can you say about the relations of students amongst themselves? Do they share things like rulers, pens and so on?

ER2: Yes I have often seen children without pens. Like they borrow pens from each other... they share pens. And I think it also depends on the Grade, because you would find in lower down ... like anywhere else you will find Grade 8s fight over each other ... you know that kind of getting to each others' way, pushing and shoving and so on.

Setsetso: Were there any cases where students helped one another for producing work that they were expected to produce individually?

ER2: Not that I am aware of. It probably does happen but I am not aware.

Setsetso: Were there any instances when teachers asked questions in public space such as on the board?

ER2: Yes.

Setsetso: How did teachers deal with the answers students produce?

ER2: Not always on the board but sometimes they ask students to answer orally. And sometimes teachers won't comment on the answer. But they would say "Let me hear what somebody else has to say?"

Setsetso: As far as you can remember were questions teachers asked directed to individual students or to the whole class?

ER2: I have noticed they are generally directed to the whole class. When teachers direct questions to individual students I have observed that in most instances, is sort of to catch this learner out ... you know like to check whether the person was paying attention. So the teacher will ask the question that is related to something that she has just said.

Setsetso: But generally the questions are directed to?

ER2: To the entire class.

Setsetso: What kind of student responses did you hear most frequently?

ER2: The "Yes" ... The chorusing ... Often what I have noticed, but I should say because I have been observing teachers two teachers, what I have noticed particularly in the one class is that the teacher will ask the question where the answer is clearly self-evident. And so entire class will chorus the answer, or else it will be a "Yes" or "No" kind of response. And the entire will respond. Where the question is a bit more challenging, I have noticed this particularly with Grade 8s, is that in each class there is probably a handful of learners who will respond and very often learners don't respond in English. They respond in isiXhosa. And the teacher would say, "Try to say that in English". The kids would then refrain from answering.

Setsetso: So generally the medium of instruction is English.

ER2: So in English lessons medium of instruction is English.

Setsetso: So there is nothing like code switching?

ER2: The teacher will say the isiXhosa word for "this is". And I think definitely it has a place. And I think the Grade 8 teacher is quite good about that ... using the code switching appropriately, in order to enhance understanding.

Setsetso: Other than the curricula related duties, do teachers have additional responsibilities?

ER2: They do. I think ... I don't know whether this is catered up, but there are people responsible for particular duties. For example, I am aware of the fact that one of the teachers that I work with she used to take minutes in the staff meeting. So that was sort of

an additional duty. I noticed that teachers played other duties during the breaks. I am trying to think... I am not sure whether teachers are involved in any extramural activities. I do know that Grade 12 teachers have a roaster where they teach after school. But I am not sure whether there are any curricula activities where the teachers are directly involved. For example, I have been running the book club at the school now. It is for the second year. This year we started the learning intervention programme and none of the teachers who join. But there is only one Grade 12 geography teacher who seats in occasionally our sessions. But none of the other teachers have volunteered to assist.

Setsetso: Where there is this feeding scheme, how do teachers participate?

ER2: There are teachers, at least two teachers that I am aware of who are actively involved in the feeding scheme. I wouldn't imagine that they cook, but they dish... they serve the learners.

Setsetso: Did students in schools you visited abide by the rules and regulations, including keeping the school uniform and being punctual for the lessons.

ER2: They definitely wear uniform ... being punctual for the lessons generally, yes. Look, I am not sure what the schools' rules are. But children often come late for school. Before school you often see kids coming late. But while at school they generally move to the classrooms themselves. But I am not quite sure exactly what the school rules are. But what I do know is that ... I suppose it also come to classroom management and also the role of individual teacher. I observed that every time Grade 8 classroom are extremely dirty. And again if the management was hands on I am sure things wouldn't be the way they are.

Setsetso: Are there other ways for maintaining discipline at school?

ER2: I know that parents are occasionally called in. I also know that learners are taken to the office. What exactly the punishment is, I can't tell you.

Setsetso: I think we are now done with an interview. Thank you very much.

ER2: You are welcome

MSEP Life skills Researcher (LR)

Setsetso: Which MSEP schools did you visit, just to observe lessons?

LR: I worked in the five MSEP schools, which are: School P2, School P7, School P6, School P3 and School P1 high school in Mowbray.

Setsetso: What is the teacher-student ratio in the classrooms?

LR: Well, it varies. Okay, if you go to school like School P1, the ratio would be about 38 to 1. But if you go to school like School P2 for example, or School P3 the ratio would be like between 48 to 52 per class; especially in the lower grades- grade 8 and grade 9. In senior grades the class ratio drop. The senior learners have smaller classes.

Setsetso: Can you describe the seating arrangement in the classrooms?

LR: Of all these five schools, the desks are in rows, except for one school. Look I am the life skills education specialist, so I do life orientation. And life orientation ask for a lot of group work. So the one school where I actually saw the teacher interacting with the learners in the seating arrangement fitted to the lesson is with School P7 high school; which make the kids work in groups. They facilitated the lesson and the kids had to report back, which is very nice! The other schools they are mostly in rows. I can understand at schools such as School P3, School P6 even School P2, there is still space there because there isn't enough desks for learners to seat. So the rows take a less space and teachers stick to those rows.

Setsetso: How did teachers move about the classroom?

LR: As I said, in the class that is very full, like the 52 learners in the class like in School P3 the teacher remains in front. At School P1 and School P6 I saw a teacher moves around in the classroom here and there ... then moves to the back of the classroom and to the front even the sides. But very seldom move in between of the rows, leaning over the learners and interacting with them like that.

Setsetso: How was the time of instruction generally managed by individual teachers?

LR: Oh! Very poorly, except for School P7 where I observed this one teacher who did ACE course with us. We taught her techniques how life orientation in classrooms should be like. You know, like how to teach life orientation lessons, there is a lot of facilitation. With the other schools the time management is very poorly people ... teachers often come late and take about 10 to 15 minutes to settle the learners down. The learners themselves, they are fighting for the space in the classrooms. Only a lesson then starts after 10 or 15 minutes. Before it ends, you know it can't be rounded up. There is no ending to a lesson, it just stops when the bell is ringing and learners are out.

Setsetso: I think you touched on this one of group work.

LR: In one class. And in fact every time when I observe that teacher, she shares her class nicely in groups. I find that she can move in between the learner seats and talks to the learners. And as a result learners ... they look forward to her lessons, because they know that they gonna be involved.

Setsetso: What about in other schools?

LR: I am actually sad because often when I go out... I go to schools once a term to go and observe the lessons. I train the teachers in one week in a workshop and the next I do follow up to see if they implement some of the training. And I am very sad because often I talk to teachers about it. They don't engage the learners enough, they don't talk to learners. At some schools ... schools like for example Suphumelela the teachers when learners come in, they don't greet learners. They take register and then they don't ask

them “how are you feeling today?” they must spend 2 to 3 minutes to engage with the learners. When the lesson ends or when bell rings the learners leave. So there is not much engagement that we really want. And sometimes I think learners are looking for that. You know that is interesting me as a person. At School P7 lady Mrs Dupreez (Pseudonym) she was very excellent. She would give different tasks to learners and before the end of the period learners knew that the groups will have to go in front to report back. And in that process she learned about the learners when they were standing in front and to give feedback. She would make the laugh and make jokes and talk about some personal things. And I think her bond with that class is very strong. They are now in Grade 11, but they still come to her when they have problems.

Setsetso: So according to what you said earlier, large group lecture method was prevalent in the schools?

LR: Very teacher-centred lessons ... very few learner-centred lessons. The teacher comes in do the talk- talk all the time. You know, they much stick to that. But there was one teacher commented to me, when I spoke to her about it. She said to me, “You know if I don’t do that I will lose control over my class. So if I stand in front and talk to them, they need to focus on me. In that way I maintain the discipline in my class. As soon as I say turn to your partner and do something and report back, then there is chaos in my class.”

Setsetso: Did you ever notice teachers interacting with individual students? If so, when did that happen?

LR: Very few. In fact I haven’t seen it in other schools except at School P7. At School P7 I saw teachers often interact with learners, in the play ground, during periods when the learners fuss with the teachers and say “Miss I have got this for you”. Then the teacher will come to the child, you know what happened. Once I also saw that at School P6 where the teachers interacted with the learners concerned maybe about something like late coming. The one teacher was calling the one girl to the one side, asking “Why are you late?” That was the first time I did. But they did it outside in the quad and everyone could see. That kind of interaction not really seating down to find out really what is the problem “what can I do for you ... to help you with your problem?”

Setsetso: In general, what can you say about teacher-student relations?

LR: Well you know many times when I work in the African schools, they speak a lot of xhosa but mostly you got that with their learners. But in the schools such as School P1 for example and School P7 ... School P1 I don’t see much interaction. The teachers to me are not interested in the learners. As soon as they can get them out of the class so that they can leave the room, that is their relations with the learners. That’s my observation for a few times that I have been to the schools. But I would like more teacher interaction with the learners. They just make them feel they are somebody, not an enemy. I often speak to teachers in my workshops about it. I say ‘You are moulding that learner and you spend more time with that learner more than their parents spend with them, therefore whatever you do with them is important. So, take more timeout and spend it with them.’

Setsetso: Are learners free enough to interrogate teachers about the content they are been taught?

LR: Ooh! That’s a hard question. In life orientation that is my speciality, that’s quite easy and I often see it. When I go to other classes, when I am there for the day I normally co-teaching demo-teaching and fight for learners to interact. And teachers I observed here and there they do that. But in the other class that I once observed is science class, just by

the way because I was waiting to use the room. So the teacher said I could come a little earlier, and I was seating and observing. They were afraid to engage the teacher in the science content. Because they were so afraid that they could be shunt. And twice a teacher in the period made comments that, "This is previous work, you should have known this already". And I think in that way is kind of switching off learners to ask questions. So they don't engage that much.

Setsetso: What can you say about students' relations amongst themselves?

LR: At this stage in their life, peers are the most important people. So at all schools I think they interact quite well. I brought students on campus here to UCT and I can see that there is this brotherly-sisterly relationship. They will help one another. The learners I work with, I never seen them got issues with one another. They have good relations with one another. They share some problems, they share some advice with one another.

Setsetso: Even some equipment as well?

LR: Yes they do. Books are easily shared and if the one has a question paper, they will copy it to the other one and they will give it to the other one. I think the learners are in the same boat, they are helping one another in getting out of this boat. The learners I work with I hardly see stinginess. They are open to share with one another, they give easily. They help one another, they assist one another.

Setsetso: Are you saying they help each other even in their school work?

LR: Yes they do. Often times we have what we call tutorials, so they go into the groups. But in these tutorials you must hear how they talk to one another about the problems. So as the tutors we normally plan to do revision with them. They talk in front, but when the school breaks go to their language. They explain to one another, they talk to one another. In the classrooms I also observed that, they are quick to help one another to understand. So that is my experience with the learners.

Setsetso: So what about in the work that they are supposed to find answers individually?

LR: My experience with life orientation where we give them something to research, they do it well. I don't know much about maths and science and other content subjects.

Setsetso: Other than their curricula related duties, did teachers have additional responsibilities?

LR: At schools like School P7 and School P1 I have seen teachers having other responsibilities. At schools like School P6 and School P3 there are no extracurricular activities. But there are other teachers who have other responsibilities, like the feeding scheme. And maybe learners will go who are part of MSEP programme, the teacher will be in charge of that. But no other duties such as sports, taking them out to place, open days. Like life orientation teaches most of these.

Setsetso: As far as you can remember, did teachers ask specific questions to individual students, or do they ask questions to the whole class?

LR: Ooh! They ask the questions to the whole class. And they sing the answer together. And when there is nobody who know the answer, the teacher doesn't even give them time to think about it or challenge them about it. She would immediately give them an answer. Do you understand what I am saying? She is not challenging them by saying, "Come on think about it" ... making analogies about learners to get to it. She would just give an answer like that. So I am not happy with that kind of teaching.

Setsetso: How do students respond when they know an answer?

LR: Like in unison. But you will see that there somebody did know the answer- there somebody did know the answer. But since everybody shouted the answer, the teacher would not make effort to assist those individuals who don't know the answer.

Setsetso: Were there enough textbooks available for students?

LR: Definitely not. Teachers copy and sometimes they don't have paper to copy ... sometimes learners have to share. There is definitely not enough textbooks.

Setsetso: What medium of instruction was used in the lessons?

LR: For the life orientation lesson I demand that the use of English, whereas I am there. But in other classes I observed the teaching is in isiXhosa.

Setsetso: Were there instances where teachers asked students questions may in public space? For example, in mathematics we usually ask learners to go and solve the problem on the board.

LR: I saw that once yes. But that was in one lesson that I observed, I don't know what the teacher does after that. But once the learners were called to the board to do the sums on the board and I don't know if that was correct. That I observed at School P6 because I was there. I am not sure whether they often do it, but I assume they often do it in that way. That was homework exercise they spent like 20 minutes marking the homework exercise. And the learners had to come to the board and do the first sum ... which I think is good, but you must also watch your time. So if that lesson of marking the homework was a suitable lesson. But if it may cost the lesson, so in the middle of a lesson you may start new knowledge or expand their knowledge ... you shouldn't spent the whole lesson just marking the homework.

Setsetso: Did students in schools you visited abide by the rules and regulations?

LR: Except for School P1, all the other schools do ... all the other learners do. School P1 has disciplinary problem, they don't abide by the rules. They will be behaving left, right and centre, but as soon as the teacher moves away, they do their own thing. I don't know if you heard about that little boy who died at School P1 two weeks ago. He ran away from the school to go and drink with his friends. And they were so drunk and they got him dead on the train lines in Phillipi. But he was supposed to be at school. I phoned the teacher at the school to ask her about what happened there. She told me that she saw the learner in the classroom but he ran away.

Setsetso: So if there is breach in discipline, how did individual teachers or the school as the whole deal with that?

LR: At School P1 nobody wants to deal with discipline. At School P7, the principal plays a permanent role. The learners are afraid of the principal. They are afraid to be seen at the office. School P2, teachers seem to manage the discipline. When learners come late, when learners stay absent, when learners don't do their homework they manage that.

Setsetso: How do they do that?

LR: I don't see them doing detention or anything like that, you know. They just call in parents once or twice at school. I saw that in School P2 where the parents were called in to talk with the learner. Parent, learner and the teacher were seating there talking about this learner's disciplinary problems. And they talk about how they may participate more on the learner's discipline.

Setsetso: Do all students wear school uniform properly in all schools?

LR: In all five schools there is a uniform. At School P3 I found that they have poor learners. They wear uniform but sometimes they would come with a different colour jersey

because the jersey is not dry or they don't have a jersey. But others would put on gray pants and white shirts without sox, you know things like that. But I think most schools, most kids wear it. At School P1, School P7 and School P2 the uniform is very important. At School P3 it is very flexible, I think because the principal mentioned to us already that the kids are very poor and in School P6 also.

Setsetso: What can you say about the rate of late coming? And how is it dealt with?

LR: Late coming at School P2, kids are locked out. Late coming at School P6, the gates are locked until the first interval and the principal talks to them. I don't know what they do with that, either there is detention. At School P1 high school they have detention if they come late. At School P7 they have detention. At School P3 the principal uses the cane, just to threaten them like that.

Setsetso: This is the end of our interview. Thank you so much for your cooperation.

LR: No problem.

University of Cape Town

Appendix 2

OBSERVATION NOTES

03-08-2011

Grade 11: Mathematics

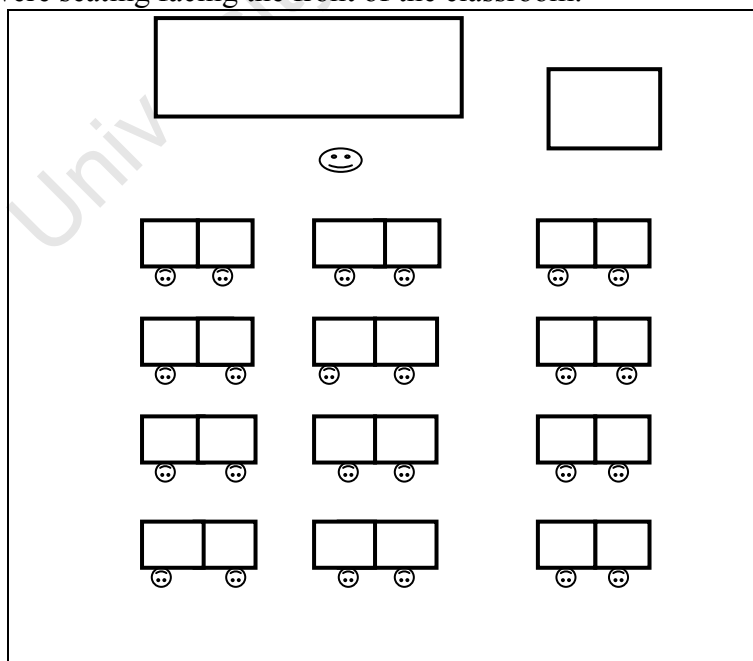
I arrived at school during the break time. The break ended at 13:00 and the bell signaled that. Two minutes later, the second bell rang, which indicated that learners were supposed to be in their classrooms. However, the learners were still hanging out and they communicated in their respective home languages such as isiXhosa and Afrikaans.

The teacher informed me about the bell situation. She said the first bell rings to alert student about the next lesson; the second bell was for alerting students that they should be seating in their class. However, the teacher told me that 90% of the students had not yet arrived. The rest of the student entered the class at around 13:15, but the students who were present in class were less than twenty. Teaching started at 13:18. The teacher explained to me that majority of the class went for physics excursion and she told me that the actual teaching would take place in the following day as she did not want to repeat the same thing. She said that, under normal circumstances the students fill up the whole classroom. She also indicated that the session was aimed at giving the students some practice exercises as a preparation for the coming test.

The room had equipment such as overhead projector and there were posters on notice boards. All the students were in a proper school uniform

The seating arrangement

All the learners were seating facing the front of the classroom.



Most of the questions that the teacher asked to facilitate teaching were addressed to the whole class. When reminding students about the 4 quadrants of the angle, she said “all stations to Cape Town”

Most of the time the teacher stayed in front of the class. It was in one occasion that the teacher asked an individual student a question.

It was once when the teacher reprimanded a student from making noise and she singled out that student by the name. Generally, the lesson was quiet but here and there some students had conversations using their different home languages. However, the teacher reprimanded them.

The students asked the teacher about something that I did not pick up but it appeared that it was unrelated to their work. This is because the teacher said she could not address that question rather they should ask questions about maths. Instead of checking the students’ individual works, the teacher solved the problem on the board.

I saw one girl who was using a cell phone and was doing nothing related to school work. Another one was sleeping and the teacher did not say anything. When the teacher wanted the students to do exercises in their textbooks, only three students indicated to have brought the textbooks. It appeared that the majority of students were not interested in doing the work. One of the students complained that the work they were given was too much.

Because of the limited books, those who did not have textbooks just had conversations and laughed. I saw one boy who took out his lunch box and ate his meal and shared it with one girl. Some of the students were throwing pens to each other, but there was the message written on the wall saying “do not throw objects around”. The teacher noticed that but she ignored them. Most students who were too vocal in the class were isiXhosa speaking. By the mere look of things, most students were not doing anything related to school work. Afrikaans speaking learners were discussing things not related to the exercise that they were given.

Some boys were making a lot of noise and the teacher got annoyed and singled out one of the boys by the name and said he lacked manners and the learner wanted to shout back but his peers stopped him. Most of the answers the students wrote on the board did not show exactly how the students got the answers and the teacher neither asked them about that. While some students were still doing the exercises, the teacher was seating in front of the class.

After some time, the teacher asked students to mark their own work. There was another boy who was using his cell phone; he was not concentrating at school work at all.

The bell rang at 2:08 pm

The teacher told me that, among all grade 11 classes at school, that particular class appeared to be the weakest and most of the students scored lower marks in June exams.

Grade 12 Maths Class: The Same Teacher

The lesson started at 2:20 pm

The class took place at maths lab like the preceding ones. The class was half full.

One student entered the class late but the teacher did not say anything. The teacher put up the formulas on the board and the students were busy copying that. I saw one girl busy with her cell phone most of the lesson. One female student went to the other side of the classroom and came back to her previous seat. The cell phone rang, and the teacher just said “is that you” and no other ways of disciplining him.

Two other students entered the classroom at around 2:30 pm there was no word from the teacher about that. The teacher moved around but she was not necessarily looking at what the students were doing. Nonetheless she noticed two students helping one another to find the solution and she reprimanded them.

The teacher went out of the classroom and came back after a few minutes. When the teacher was out, there was a lot of noise from students. Some were assisting each other for obtaining the solutions.

Later on, one teacher entered the classroom and they had a long talk with the teacher in charge. The teacher solved the problem that she gave to students on the board. While doing that, she was asking some questions to the entire class which mostly required short answers, and the students responded in unison. Two more students entered the class at 2:40 pm, like before the teacher did not make any comment. I saw once when the teacher interacted to an individual student and it was when the student was showing the teacher a mistake that she made.

When the teacher asked a question about the sums of geometric sequence to a particular student, students answered in a chorus. Most of the time, the teacher solved the problems herself without checking the students' answers.

In total, only three questions were done for the entire lesson. When the teacher asked the students about the next lesson of mathematics, they said they would have it the following Wednesday, some said on Thursday and Friday, others complained that they did not want an over dose of maths.

At 2:54 pm, the teacher wrote the page and exercise numbers of the homework. The teacher said the students should start answering some of the questions, but they just made a lot of noise doing nothing, waiting for the bell to ring. During the entire lesson, I never saw the teacher marking students' books. Some students went out before the bell rang and the teacher was also out at that time.

The bell rang at 3:03 pm

The teacher told me that in the previous year 60% of the Grade 12 students performed poorly in mathematics.

In the previous day the data collected was inadequate hence I decided to revisit the school

04-08-2011

Grade 12

I arrived at school during the break time which started at around 12:30 pm.

Some teachers were seating in the staffroom having their lunch, whereas others were busy on their laptops. The bell rang for the next class at around 2:30 pm. The teacher who I observed arrived in class at around 2:43 pm. The class took too long to settle down. The class took place at the science lab. Some students were moving in and out of the classroom; the teacher seemed to ignore them.

The teacher was arranging for the extra lessons during the weekends, and the majority of students were not pleased with that. The teacher went out for quite some time. While he was out, some of the students who did not belong to that class entered will-nilly and later went out. The teacher told the students that they were definitely going to fail matric because of their lack of commitment. However, there was no one that seemed to be troubled by the teacher's statement, given that they continued making noise.

One student moved about the classroom and there was no word from the teacher. Another female student entered the class 10 minutes late, two minutes later another student entered. While the teacher was distributing some work sheets, one girl moved out.

At around 2:54 pm, five more students entered the classroom. When the teacher was talking, the students were not listening at all. He kept on begging them to listen in a number of occasions during the lesson, but he was completely ignored. The two boys were standing at the centre of the classroom. There was talking all over the classroom and two boys were standing at the door, others were moving about the classroom. At that point in time, the teacher was standing in front of the classroom.

It appeared that students were free to do whatever they wished to do. One boy stood at the door for some time and there was another student from outside whom he was having a conversation with. For the rest of the lesson, none of the students were seen doing any of the school work or reading the work sheets that the teacher distributed. There was no ethical teaching in that lesson. I saw two boys busy looking at the cell phone and other two learners leaving the classroom before the end of the lesson.

That learner I mentioned earlier still remained standing at the door. Another was standing at the centre of the classroom browsing her cell phone; another came towards her holding her own cell phone. It appeared that students were not scared to confront the teacher but they did not do it in a respectful manner. They did not even put up their hands before they could speak. That resulted with a lot of voices talking at the same time to the teacher.

It looked like, the lesson was aimed at introducing students to a physics project, because some of the voices heard, were asking the teacher about writing an abstract. It was in one occasion that the teacher interacted with a group of students who appeared to be interested in doing the project. At 13:15pm two students entered the classroom and there was no word from the teacher. When they sat down, they were busy on their cell phones.

One student was seating on the table in front, looking at the back of the class. The teacher just ignored him. The class was extremely noisy. The teacher only interacted with a few students who showed some interest. One girl was busy combing the hair of a certain boy. The students were communicating to each other in their home languages, either isiXhosa or Afrikaans.

The teacher was communicating in English throughout the lesson. The teacher answered a call during the lesson and he moved out, and then entered later. At 3:26 pm the teacher told the students to discuss the last chapter of the project, no student showed any interest to that. The students used English when they talked to the teacher. Most students already left the class before the bell could ring. The bell rang at 3:33pm, but there were about five students who remained in the class till the end of a lesson.

The class was equipped with overhead projector and other equipment for carrying out experiments. There were also posters and periodic table on the notice boards.

10-08-2011

Grade 9 Natural science

The lesson was supposed to start at 1:00pm but it started later than that.

NB: the teacher warned me beforehand about the behavior problem in that class.

In our arrival, the classroom was too noisy and other students were looking through the windows towards the fields of play. I saw one girl throwing a chair at another student and the teacher seemed to ignore that. The teacher asked the students who were present to settle down while waiting for others to arrive. It appeared that they ignored his request because they did not move to take their seats.

The majority of students started entering class at 13:12. During that time, the classroom was still half-full. However, there was a large group of students standing outside the door.

The teacher requested the students to submit the work he gave them in the previous day. When he realized that some students were reluctant or were not in the position to do so, he said those who were willing to submit should do so. Eventually, there were no students that managed to submit their work, and the teacher did not make any follow up. One student entered the class at 13:16, while those who were standing outside ultimately entered. One boy standing outside was whistling which really disturbed the proceedings of the class, but the teacher took no action to address that.

What appeared to be the last bunch of students entered the class at 13:20. At their arrival, the class was extremely noisy. One boy tried to take away one girl from a seat, seemingly he was accustomed to seat at that position. The teacher intervened by transferring him to the teacher's seat in front of the class, but that seemed not to stop the boy from acting mischievously. The teacher warned the students that whoever made noise would be sent outside. But the noise escalated and there was no action taken against that. He told the students that if they did not pay attention they would fail because they would not understand what had been taught. He also stated that the student should be responsible for their learning as that is their main purpose of being there. In addition, he stated that he was not the one who was there to learn, but solely for helping them in their learning.

The teacher asked one of the students to stand at the centre of the class and read the paragraph on a handout. While she was reading, some students made irritating remarks and it appeared that they were most certainly not interested to listening to the story in the passage. When that student had finished reading, other students made a non-stop applause which caused a lot of noise. It appeared that their intention was to disturb the class. The teacher waited for a moment until the students stopped that kind of noise.

The student who the teacher took to the teacher's chair made a lot of noise pretending to be the teacher. He kept on shouting "guys, please..., please!!!" The teacher asked the students to do a task but majority of the students appeared to be not interested. Students were talking among themselves in their home languages (i.e. IsiXhosa and Afrikaans). Some of the students were just sleeping on their tables. The boy seating on the teacher's desk put his legs on the table and he did not look at the handout that he was given. After sometime the teacher appeared to be explaining something to him. At that moment, some students were moving around the class, perhaps they were sharing some information about the task that they were given, even though it was meant to be done individually. The classroom was extremely noisy. But the teacher did not reprimand the students.

The teacher moved around to check what the students were doing. He came across a group of students who were not doing anything regarding the task that the teacher gave. When trying to talk to them, the students just laughed at him. He did nothing to discipline the students. He just went to the front of the classroom, where he was positioned in most of the time during the lesson. Some students were helping one another to answer questions on the handout.

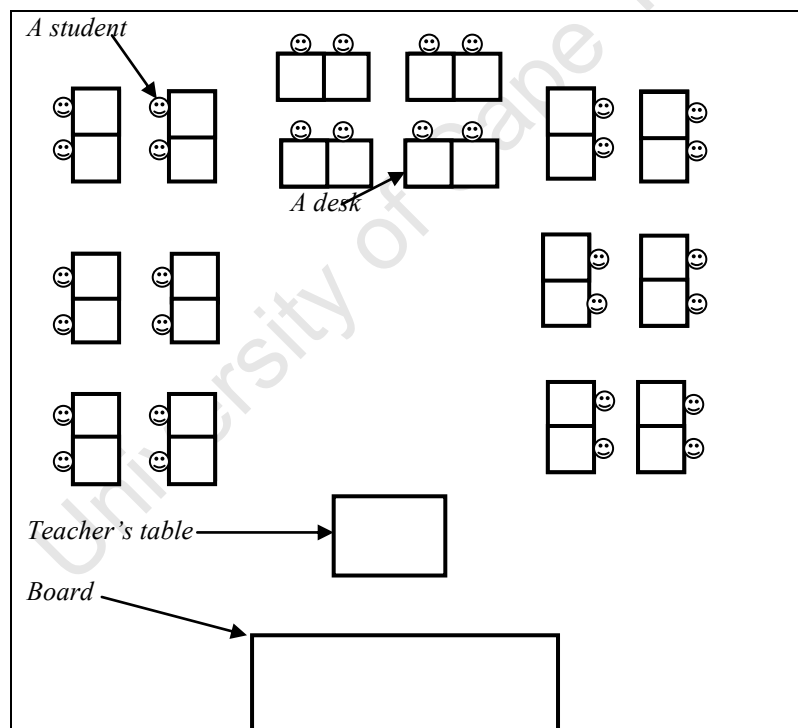
Later on the teacher took another round for checking students' work. He interacted with some individuals and gave some explanations on the 'force of gravity' (that was the topic of the lesson). The teacher went back to that group which appeared to be notorious, and asked them how far they were with their work and one boy said they were struggling, while the rest just laughed. Nevertheless, the teacher did not interrogate them any further.

One student went outside without the teacher noticing. Later on another student also went out. The lesson seemed to be chaotic because the teacher lost control of the class. The students were supposed to hand in their work at the end of the lesson. However some students were able to submit while others did not. One female student went out again without the teacher noticing, maybe it was because he was explaining something to an individual student. Another student, a female again went out. It appeared that students were moving around to look for answers from their peers.

The lesson ended at 14:00

When I left the classroom, it was before the bell went off, I came along the students who were crowded at the corridor, perhaps they also sneaked out of their respective classrooms. The whole corridor was buzzing with a lot of noise which definitely disturbed the lessons in other classes alongside that block.

Seating arrangement



Appendix 3

OBSERVATION NOTES

02-08-2011

Grade 8: Business Economics

I arrived during break time, and the students were having their lunch. I was told that it was provided to all students for free. I arrived at school at around 11:30am. However I could not access the classrooms perhaps because the principal was not around. The teachers whom I first met in the boardroom were skeptical to let me observe their lessons, and some told me that they would not have any problems for being observed once I got permission from the principal. Nevertheless, that appeared to be an excuse. This is because apparently they were aware that the principal was not at school on that day. I went to the staffroom to negotiate with some teachers about observing them while teaching, but there was only one teacher who reluctantly granted me permission to observe his class. Majority of the teachers were seating in the staffroom in groups of eight per table. There were conversations from each table and they communicated in isiXhosa. Later on, the deputy principal came and we talked about classroom observations and she had no problem with that, it was around 12:45pm.

The first lesson that I was supposed to observe was physics, Grade 12; unfortunately the lesson did not materialize because the overhead projector which the teacher intended to use did not function properly. I was then promised that possibly I could attend the next lesson. But before then, the teacher was supposed to be in class at 13:00, but he was late by 15 minutes. On our way to the classroom, a lot of noise was heard from most of the classrooms. It appeared that there were no teachers in those classes at that point in time. We met some teachers who were still going to classrooms at the corridors, and they were about 20 minutes late for the lesson.

As the period which I was supposed to observe approached, I waited for the teacher outside the classroom which he previously showed me. Instead of remaining seated in the classroom waiting for the teacher to arrive, the students were playing outside the classroom. By the look of things, there were no teachers in the nearby classrooms as well. While other students were playing outside, those who were in the classrooms made a lot of noise. By the time they saw the teacher coming they rushed and forced their way into the classroom. The lesson was supposed to start at 13:45, but the teacher came at around 13:55.

Most of the time, the teacher was standing in front of the class writing on the board. Often, the questions that he asked were addressed to the entire class, in return the students often responded in a chorus. For the whole lesson, the teacher used both English and isiXhosa when teaching. It appeared that not all students had equipment such as calculators and had to share with their peers. The chalkboard had English language content written on it, but the teacher did not bother to erase it, even though it appeared to obscure the perfect view of what he wrote. Some students were not paying attention at all to what the teacher was doing on the board. Instead, the class was extremely noisy especially when the teacher was writing on the board. Surprisingly, the teacher did not do anything to reprimand the students from making that noise, but he continued teaching. The students were communicating in isiXhosa amongst themselves, even to the teacher. The noise from other nearby classrooms could be heard.

One student was asked to come up on the board to solve the problem which was exactly the same as the example that the teacher gave, but the only difference was the values. However, the student struggled to find the solution and was looking for assistance from other students.

Most of the students were not concentrating on what the student working on the board was doing. They were playing and freely making a very irritating noise.

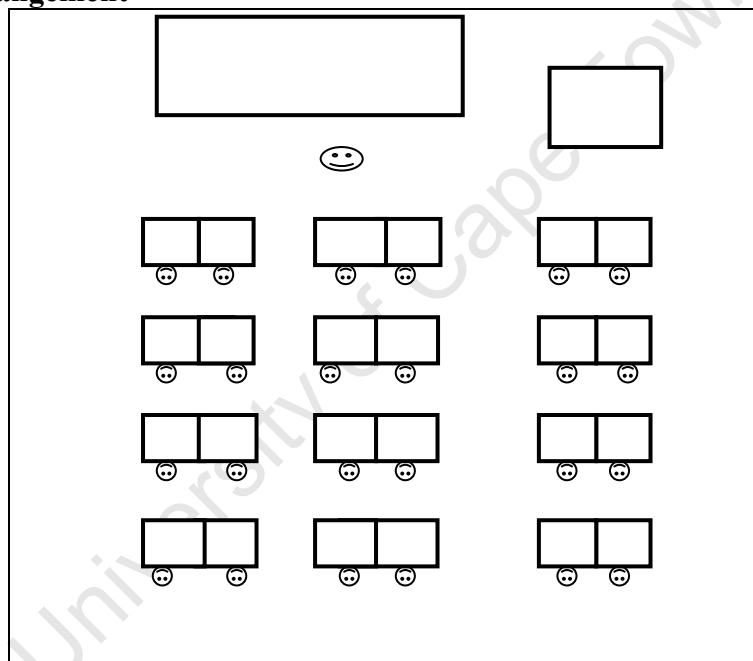
The teacher commented that, the student took about 7 minutes instead of 2 minutes and he emphasized that the ‘time factor’ is very important to consider when answering questions especially in the examinations.

Later on the teacher said that there is no one “entitled” for talking or laughing until they finished their class work. After saying that, the class became fairly quiet. However the noise from the nearby class could be heard. It was in a few instances that the teacher interacted with individual students but he was not marking books and he said he did not have a red pen. Nonetheless, one student volunteered to lend the teacher one.

While the teacher was marking the books of some individual students, the noise erupted again. The students were helping one another to arrive at the answers. The teacher even made a comment that some students were not writing anything because they wanted to copy from those who got the correct answer.

The lesson ended at 2:30 pm.

The seating arrangement



The class looked not crowded and the students were about 40.

Most students were in their school uniforms, but some were wearing private jerseys and jackets. Some of the boys were wearing hat caps of various colors.

The school is in the close proximity to the residential area of the community it serves. From the talk with one of the teachers, I learned that it is the school’s policy for admitting students who stay at a nearby area.

Appendix 4

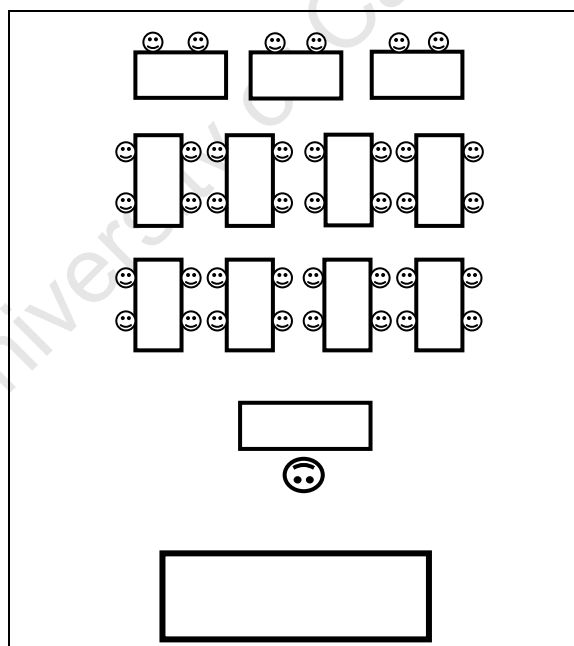
OBSERVATION NOTES

26/05/2011

On my way to school there were some students in their uniforms along the streets who were heading towards the school but it was almost towards the end of the first lesson.

Grade 12 isiXhosa lesson

The lesson was in progress when I entered the classroom. It was at 9:39am. The principal accompanied me to the class and introduced me to the teacher who was in charge. The door got locked while the principal was inside. It took him a while for opening it, and that interrupted the progress of the lesson. Some students were shouting and said they want new doors. In response the principal said the school does not have money. The desks were closely packed and were arranged in columns. The students stood facing each other, except for those who were sitting at the back. The classroom was congested even though some chairs were still empty. The teacher was standing in front of the class and most of the time was writing on the board. There was limited space between the desks as well as in front of class and this restricted the teacher to move around the class to help individual students.



One boy arrived late, but there was no word from the teacher.

Almost all questions were asked to the entire class and students often responded in a chorus.

The teacher did not call students by their names for the whole lesson. The students did not volunteer to give answers individually (i.e. they did not raise up their hands at all).

When the class was still in progress the handyman entered to repair the door. This interrupted the lesson because the teacher talked with for about 2-3minutes. Throughout the lesson, some students continued with their conversation which was apparently not related to what they were being taught.

A lesson Ended of 9:54am

Grade 8 English lesson

10: 06am

The next class started 10-12minutes later because students were moving from one class to another. Some students entered class while the lesson had already been started.

The class was heavily crowded. The teacher's space was very limited in front of the class. The desks were closely packed so much that it was totally impossible for the teacher to move around the class to help individual students.

Most of the questions that the teacher asked were directed to the entire class, but most students showed the teacher that they were willing to give answers by raising their up hands. The teacher pointed at one student who was willing to give an answer without calling them by their names.

It appeared that it was only a teacher who had a textbook in class, as there were no students who had books in front of them. One student volunteered to draw a diagram which demonstrated contents of one poem written in a book on the board. She used the same book which was on the teacher's desk. The student spent a lot of time of about 12minutes for drawing a picture. At last the teacher seemed not to be satisfied with the drawing and called another learner to come on the board to draw his version of diagram using the same poem. The second student also spent almost the same amount of time to draw that diagram.

At that time the class was too noisy and most students were having conversations in isiXhosa throughout the lesson. Others seemed like they were not concentrating at all while some were laughing at the drawing and making some silly unusual sounds. As a result the teacher lost his temper and told the students that, "here at school I am your parent, I deserve the same kind of respect that you give your parents at home."

After that, the teacher seemed unsatisfied with pictures that the students had drawn previously, and then he decided to draw it himself. The teacher confessed that he was not good at drawing. To students the diagram that the teacher drew was worse than the previous ones because they made funny remarks in isiXhosa. This also consumed a certain amount of time which really unnecessary. After explaining his diagram, the teacher wrote questions on the board for the whole remaining time, and the students copied them into their books. It appeared that the sitting arrangement was problematic because some students often asked for clarity on the words written on the board, as such arrange denied them perfect view of the board.

It appeared that students took advantage of not being noticed by the teacher. Instead of answering questions in their books, the students continued making noise and it was now getting too extreme. At that time, some students who seemed to be older boys and girls sitting at back threw papers at each other. The teacher shouted the name of a girl who appeared to be the most notorious and trouble maker, in trying to reprimand her from making noise and also from throwing papers. The girl shouted back at the teacher in isiXhosa with sentence starting with "haye boo..." ending with "chini!!" the teacher appeared helpless for not being able to control that girl. At that time, the other student were shouting saying "mubethe tishala" which could loosely be translated as beat her teacher.

The class was noisy throughout the lesson and the teacher tried to control that noise several times, but students seemed to ignore him. It appeared that he surrendered because he even made a remark, "I don't think you are interested in education at all".

The lesson Ends at 10: 42am

After the lesson, the teacher complained about a few students who he indicated that they were hooligans. He further clarified that those students were repeaters.

Same Grade 8 class Maths lesson

The class had to resume at 10:50am because the students had to move around to get to other class.

The sitting arrangement was the same as the one shown in the figure.

The teacher told me that the lesson was mainly meant for revision. It appeared that the topic that the teacher wanted to look at was fractions.

While still writing examples on the board, the students started making noise. In trying to control that the teacher said, “Make sure that I do not get you, because you know exactly what I will do to you”.

He wrote BODMAS and examples that follow on the board:

a) $\frac{1}{2} \div \frac{1}{3} \times \frac{3}{5}$

b) $\frac{1}{3} \div \frac{2}{5} + \frac{1}{2} \times \frac{3}{4}$

c) $\frac{2}{3} \div \frac{1}{2} + 4$

The teacher asked one girl to come up and solve the problem on the board. The learner solved the problem by selecting two terms and simplified them. After that she brought the simplified terms together in order to arrive at a final solution. For example:

$$\begin{array}{r} \frac{1}{2} \div \frac{1}{3} \times \frac{3}{5} \\ \frac{1}{2} \div \frac{1}{3} \\ \frac{2 \times 3}{1 \times 3} \\ \frac{2 \times 1}{3} \\ \frac{2}{3} \\ 1\frac{1}{2} \end{array} \qquad \begin{array}{r} 1\frac{1}{2} \times \frac{3}{5} \\ \frac{3 \times 3}{3 \times 3} \\ \frac{2 \times 5}{9} \\ \frac{9}{10} \end{array}$$

The girl managed to get a correct solution. A teacher asked a student to explain to the class as to how she changed a mixed fraction into an improper fraction. The learner fluently explained what she did in isiXhosa, and the teacher did not mind at all.

The learner who solved second question followed the same procedure but seemed to struggle at a certain step. The learner who solved the first one tried to help, as she was not sitting far from the board. But the teacher did not allow a learner to complete a solution, as it was clear that the learner could not find a correct answer. By the time he left the board the boy wrote the following steps:

$$\begin{array}{r} \frac{1}{3} \times \frac{5}{2} \\ \frac{1 \times 5}{3 \times 2} \\ \frac{3 \times 2}{5 \times 2} \\ \frac{6}{10} \\ \frac{6}{10} + \frac{1}{1} \end{array}$$

The time the students spent for solving these two examples was between 20-25 minutes.

The third learner was invited to solve last example. He followed the similar method, but unfortunately his solution was incorrect. His solution was as shown below:

$$\begin{array}{r} 1 \quad 5 \\ \frac{1}{3} \times \frac{5}{2} \\ \hline 1 \times 5 \\ 3 \times 2 \\ 4 \\ \hline \frac{4}{3} \end{array}$$

$$\begin{array}{r} 4 + 4 \\ \hline 3 \\ 8 \\ = \frac{8}{3} \\ = 2 \frac{2}{3} \\ \hline 4 \\ = \frac{4}{3} \end{array}$$

The teacher went through all the examples including the one which was solved successfully using the same algorithm. At the time he was doing that he asked questions to the entire class and sometimes to individual students who he singled out by their names. Most of the questions he asked were so obvious such as, “which fractions are dividing each other in question 2”. Even in that lesson students often responded in a chorus, repeating the answer which was already being provided.

In most instances the teacher addressed the class in English but he also used isiXhosa occasionally. After hearing some whispers at the back the teacher identified the perpetrator and asked her to see him immediately after the lesson. A learner looked a bit disturbed.

However, unlike in the previous lesson I observed, the same learners were relatively quiet for whole lesson.

It could easily be predicted that the teacher intended to ask the similar questions in the June examination. This is because he gave students more questions of similar format. He further advised students to seek help from their brothers and sisters while at home. While the teacher was writing questions on the board, one boy came to ask for permission to go outside and the teacher declined it. At the other side of class, one boy threw a paper at one girl who also retaliated, and the teacher noticed him. The teacher told him that he was going to sweep the classroom on Friday.

The teacher was supposed to collect homework at the end of a lesson. He said he wanted to use a class list in order to ensure that everyone end up handing in their work. Nevertheless he gave those who did not do the work a grace period of submitting on the following day. There was no student who happened to submit their work at all as far as I can remember.

The lesson ended at 11: 25am and it was break time.

At the end of the lesson, the teacher helped one male student who came to seek some assistance. After I had a small chat with the teacher who told me that he was not a teacher by profession. He indicated that he did a three year BSc degree in Zimbabwe majoring in Biology and Chemistry, and intended to pursue his career in UCT medical school. From my observation, I realized that that young teacher understood isiXhosa and can speak it fluently, even though he was a foreigner.

On my way to the staffroom, I noticed that the learners were in differing attires. Some were in the private clothes mostly boys, while others were in school uniform. Even those who were in school uniform did not wear the same colours. Some girls were wearing gray flannel trousers and others wore blue dresses. Most boys were wearing gray flannels while some were in their khaki trousers.

There was a lot of noise all over the place, and the language that students were communicating in was isiXhosa.

In the staffroom the teachers were sitting in cluster groups which appeared to be based on their personal friendships. Most of them were communicating in isiXhosa, except for the group of three teachers who communicated in unfamiliar language, most probably Zimbabwean Shona. These teachers contributed coins and sent a student to buy drink for them. The conversations seemed not to be related to matters involving their work, but were mainly concerned with personal matters. Four female teachers sitting side by side who were not far from me were talking about roasting chicken in an oven together with vegetables. The break lasted for about 45 minutes. A fellow researcher told me that it was a common practice at that school to have one long break, in order to give students who are in the programme of feeding scheme to be served. She told me that the students often stand in long queues especially when the meals were relatively “nice”. The break ended at 12:10pm, but most students as well as teachers took long to get into classes.

Grade 10 Physical science lesson

I entered the class while the lesson was already in progress. The sitting arrangement was same as in the other classes that were observed. The class was crowded, so much that it was difficult for the teacher to move around to check on each individual student.

The teacher carried out an experiment separating the mixture of salt and soil. The apparatus available were only used by the teacher for demonstration. The teacher stirred a mixture of soil, water and salt with her pen, but she told students that she was supposed to use a stirring rod.

Later on the teacher filtered the mixture with filtering apparatus (conical flask, filter paper and a funnel). She told learners that it would take for too long to get the solution of water and separate from soil. She indicated that if there was a laboratory, she would leave the mixture to filter out completely. She noted that ideally she would use the distilled water to make the mixture, but unfortunately it was not there at the school at that time. Therefore, she made a solution of water and salt which she wanted to evaporate it.

The teacher did not have matches for lighting Benson burner, but she asked whether one of the students could borrow her. Then, one boy who appeared like he was in his early twenties volunteered to lend a teacher a lighter. Then some students made some remarks that showed their admiration for their classmate. Some shouted, “yo yo yo scoco!!” which could be loosely translated as “top dog” which is usually linked with bravery. The teacher made a joke that she did not have a problem in using a lighter because she was once a smoker too. The students laughed in return.

When the teacher was still carrying out an experiment some students especially at back of class could not see what the teacher was doing in front because they were obstructed by the students who were sitting in front of them. Some remained standing to witness the outcomes of the experiment, while others did not bother to do anything at all. Some students were chatting with each other in isiXhosa for the rest of the lesson. It was obvious that they did not talk about matters relating to the experiment that was carried out, because they did not pay attention at all. Some female students exchanged missives of papers which appeared to have been carrying messages written on them. Evidently, one girl after receiving the paper threw back some sweets to her friends. It appeared that the teacher did not notice that, as she was still busy in front.

The teacher asked questions to the entire class and students often responded in a chorus. She was never heard calling the students by their names or interacting with students individually. The sitting arrangement and overcrowding made it difficult for the teacher to move if ever she would need to.

The white board was written upon by a black permanent marker, and she continued using it, as it appeared that she had no alternative. She used an orange marker which I realised was

also problematic. It was only the students in close proximity that had a better view of what was written on the board.

The teacher communicated in English throughout the lesson. She concludes the lesson by telling learners that they should bring questions that they would want to ask her the following, as she would not entertain that when the exams resumed.

Lesson ends at 12:47 pm

General information

Chatting with the teacher after the lesson, she told me that she is from Zimbabwe. She indicated to me that they lack facilities as they only have one laboratory which is also used as a classroom. She pointed out that if the facilities were there she would divide students into groups and let them carry out the experiment on their own.

Grade 9 Natural science lesson

It was 1:08 pm when me and the teacher entered class.

The sitting arrangement was similar to the other classes that were observed.

The teacher told me that lesson was about the projects. The teacher distributed what appeared to be different copies of textbooks to the students who were divided into groups of 5-6 students. While she was busy doing that she communicated with students in isiXhosa. She moved around the groups seemingly to assign students different tasks. It looked like the teacher moved around with difficulty because of desks which were closely packed.

Another teacher entered and appeared to mark some students' books. She spent something like 5-6 minutes. Later on, she went out with a pile of books.

One boy threw a paper towards the group which the teacher was busy with. The teacher noticed that boy and asked him to kneel in front of the class as a punishment.

A teacher spent a long time in one group of approximately 10 min.

It was noisy throughout the lesson which overpowered teachers' voice, and the teacher did not ask learners to lower down their voices either. It looked like the textbooks that the teacher brought were not enough. She requested those groups that she gave books first to deliver those books to other groups that did not have textbooks.

There was a busy movement of students from one group to the other. I also saw two students going out of class at different times without teacher's consent. The one who came back brought a bottle of water which was shared amongst fellow classmates.

The teacher requested one girl to write something on the board which was in the textbook that she gave her for other learners to copy. At the time when the bell rang the teacher only checked with 3 group out of the total of 10. It was hardly easy see if there was any progress in that class.

Lesson ended at 13:35

General information

The school is very close to residential area, and gives an impression that majority of the students served by the school come from that area. Fellow researcher told me that there is a feeding scheme at school funded by the state. She said that initially the scheme was meant for the students come from the poorest of the poor families, but presently it also covers all the students who may want to have meals. She further indicated that some teachers play a role of cooking food and serving meals for students.

She told me that the number of teachers in the school was between 30 and 40, whereas students were slightly over a thousand in number. She pointed out that the number of Grade 8 students ranges between 55 and 60; in Grade 9 slightly above 50; and Grade close to 50. She

showed me an age list of Grade 8 students. The youngest was 13, the oldest was 18, and the average age was 14 years.

I was also informed that the teacher who teaches English that I observed earlier did not attend the last lesson, and it appeared that he was not there within school premises. My fellow researcher told me that she became aware of that when some students asked for permission for going out for drink some water, as their teacher was not present in class.

After school as I walked around classes, I saw a group of students discussing mathematics past papers. One of them was writing on the board.

I had a privilege of observing English intervention programme lesson. I was previously told that the students who attend those lessons were five, but in that lesson those who were present were only three. It appeared that the student spoke English to the teacher only, but continued to communicate in isiXhosa to each other. Their teacher seemed to ignore that.

I asked why the turn up of students in this programme was so poor, and was told that may be the students as well as the teachers do not have any interest. She told me that all necessary arrangements were made and the letters informing parents of the Grade 8 students about the programme were sent.

University of Cape Town

Appendix 5

OBSERVATION NOTES

8th – 9th June 2011

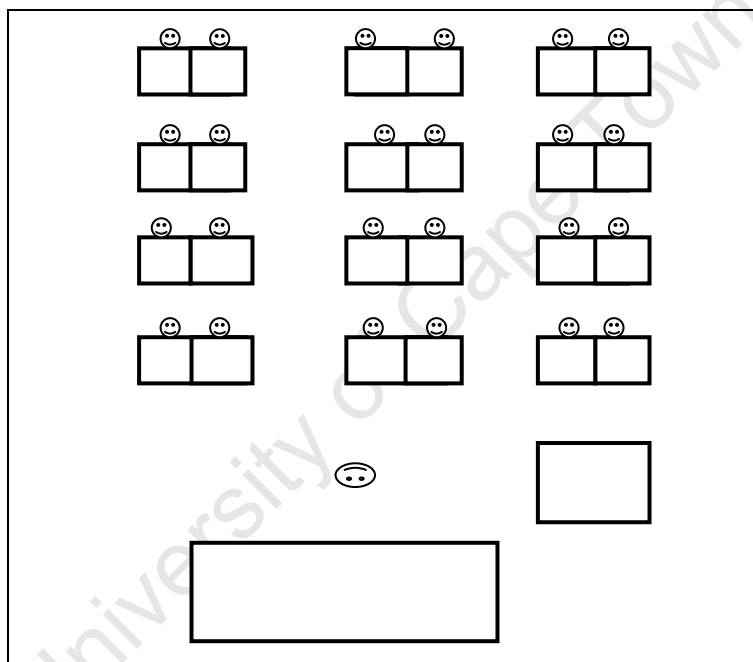
Grade 10 Mathematics lesson

I arrived at the school at 11:15am to observe the lesson which started at 11:20am.

The lesson actually started at 11:34am

Seating arrangement

The two tables are joined together and arranged in columns and rows as shown in the figure below.



The learners in this class are around 30 in number, and in most tables students of the same sex were seating together (i.e. a boy was seating next to another boy – the same thing with the girls).

There appeared to be a lot of space between the tables, so it would be easy for the teacher to move around.

The topic of the lesson was 'Exponential functions', and it was clearly written on the board. The teacher was often found standing in front of the class writing on the board. It appeared that the teacher posed questions to the individuals but those individuals remained silent. However, when the teacher directed questions to the whole class the students answered in a chorus.

One student entered late, but she went to report to the teacher before she could seat down. Another student came to fetch papers belonging to the teacher who taught in the previous lesson. That seemed to have interrupted the flow of a lesson, because the teacher had to stop and to listen to what that student was looking for.

The teacher communicated in English but here and there he code switched to isiXhosa. The students often responded to the teacher's questions in isiXhosa. They also communicated amongst themselves in isiXhosa.

Using the general exponential function $y = a^x$, he asked students to investigate a function when $a = 1$ (i.e. where a function is $y = 1^x$)

It appeared that most students realised that for all values of $x \in \mathbf{R}$, the function becomes a straight line with an equation $y = 1$. For some reason, the teacher went through that problem on the board again, even though it appeared too obvious. However, the teacher emphasised that $0 < a < 1$ and when $a > 1$ the function becomes a curve.

The students were asked to volunteer to solve the problems on the board but no one seemed to be willing to do so. The teacher moved around to check what students were doing and helped some of them. Not all Students seemed have equipment such as calculators and pencils. One student threw a rubber to borrow another who was seating on the other side of the class. I noticed that some students were helping each other to arrive at the answers, even though the teacher expected them to work individually. Nonetheless, the teacher seemed to be unconcerned.

He asked the students to solve the following function: $f(x) = \frac{1^x}{2} + 1$

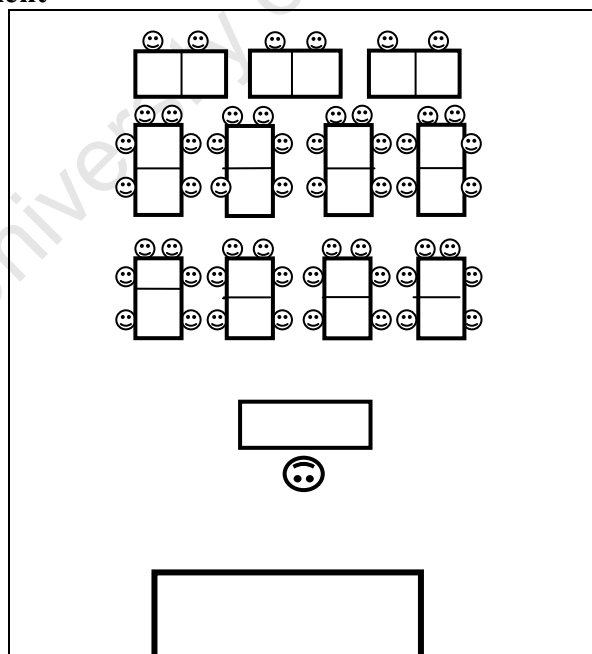
The teacher was not marking the students' work. He just asked students in general as to how many of them got the answer correct. After a few claimed to have got the answer correct, he did the correction on the board.

At 12:05 pm the bell rings, the teacher seems to continue with the work on the board.

Another grade 10 maths lesson the same teacher.

The lesson starts at 12:37pm.

The seating arrangement



The students were seating in groups not necessarily arranged by the teacher. The class seemed to be very crowded denying any possibility of movement around, if the need might arise. Most of the questions were posed to the whole class, and learners responded in a

chorus. The teacher called students by their names when requesting the individual responses from the students. The teacher was seen standing in front of the class most of the time. Individual students were called by their names to give answers, but they gave quite different answers. The teacher kept on asking the same question to other individual students. He did that to more than 10 students. One student said his answer was the same as his neighbour's, and the teacher asked if they copied from each other. But the students denied that. In fact, majority of students were seen helping one another to find answers that they were expected to find individually.

The teacher did not use the discouraging remarks to student's answers because he kept on saying, "interesting answer" or "that's exciting". After realising that most students were giving incorrect responses, he explained the notion of asymptote to the learners.

Students responded to the teacher's questions in English; but used isiXhosa when speaking amongst themselves. The class paused for a few minutes to wait for the student who went out to fetch a duster for cleaning the board. That student went out for too long. At that time, the students and the teacher were communicating in isiXhosa and the class was too noisy. When that boy came back, he told teacher that he did not find the duster.

The bell rang at 13:07 pm.

Data collected on the 8th June was not enough to make informed conclusion as I only observed two lessons for one teacher. I decided to go back to observe more lessons the following day.

General information

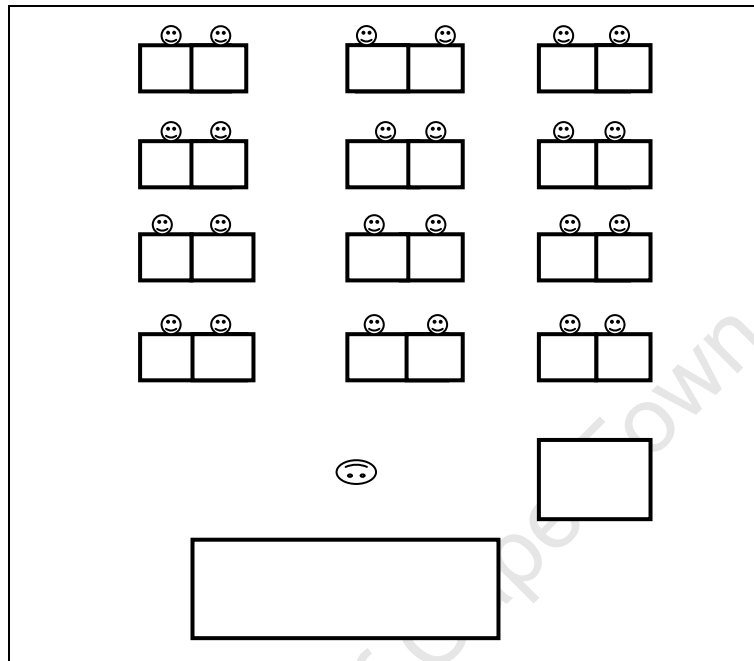
The majority of students were in school uniform, but with different combinations. Some girls were wearing track suits while others were wearing their usual navy-blue tunics. The staffroom is fully furnished with tables, lockers and T.V. There are also 4 computers.

8th June 2011 Grade 12

Maths lesson

Lesson starts at 10:46 am

Seating arrangement



The classroom was equipped with overhead projector, speakers, mathematics and science posters on the walls, and the white board.

The class was spacious and if the teacher intended to move around he could do that with great ease. One student entered and looked like he came to take something from another student. He reported to the teacher before he could do that.

The topic of the lesson was compound Angles

Most frequently, the teacher posed the questions to the whole class. The students in return responded in a chorus. The teacher showed students how to prove the compound angles. Some students complained that the teacher was confusing them by what he was writing in the proof. Then the teacher asked one student to explain to others. I missed the explanation because it was communicated in isiXhosa. However, the teacher assured the students that in the syllabus it is not necessary for learners to know how to prove angles.

The proof consumed a lot of time, and most of the work was done by the teacher on the board. The students only contributed by answering the questions which were self evident, such as those which required learners to recall $\sin \theta = \frac{O}{H}$ and $\cos \theta = \frac{A}{H}$

The teacher claimed to students that he allowed chorusing deliberately because he did not want to embarrass those who did not know the answer.

During the teaching, the teacher switches to IsiXhosa. Most frequently the teacher asks questions like “Are we together?” “Do you understand?” In all those instances students answered those questions with “yes”.

In a few occasions, the teacher alerted the students to raise their hands so that they answer individually. Then the students remained silent and the teacher called the student by the name to answer the question, then the student responded in isiXhosa.

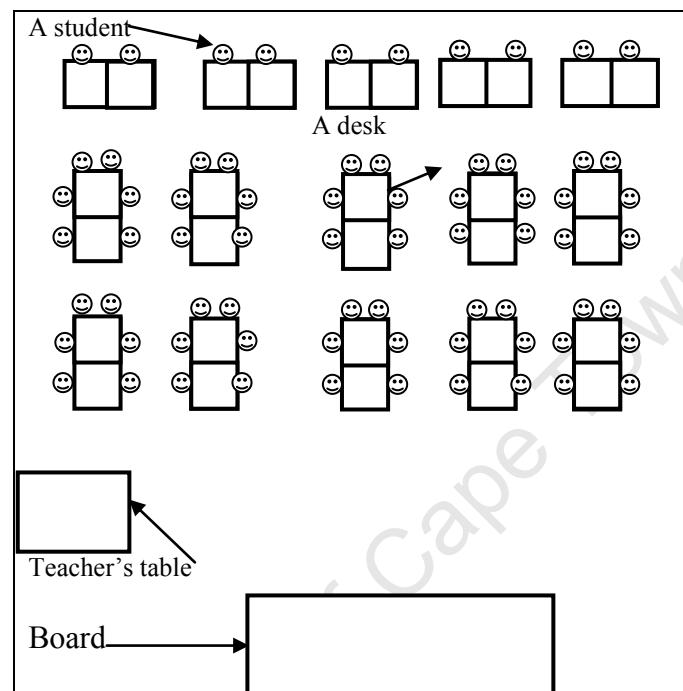
The teacher allowed time for questions but students did not use the opportunity.

The bell rang at 11:23 am

Grade 9 Maths

The lesson started at 11:28am
The classroom looks too small.

The seating arrangement



The seating arrangement denied some learners a perfect of what was written on the board. The teacher moved around to sign learners' books. She asked students to exchange their books so that they mark one another. She called one student to solve the problem on the board. At that time, one student entered the class and it was around 11:34 but she was not asked anything about her late coming. It appeared that there was a shortage of chairs, and the students joined two chairs and three of them seated together.

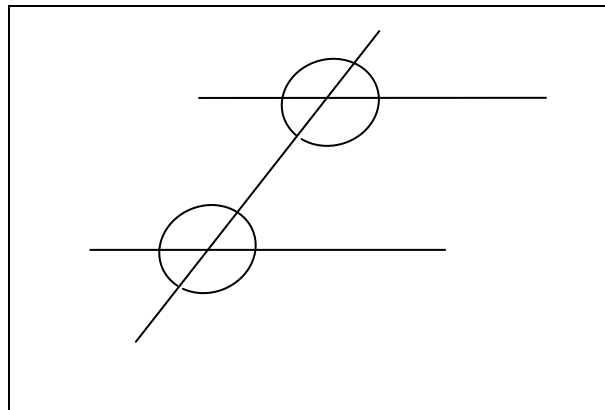
Most of the time, the students communicated with the teacher and amongst themselves in isiXhosa. The student who was working on the board was assisted by the other students to write down the correct answer. Students were asked to answer and give the reason for that.

Most students volunteered to find each angle. The students solved the problem for whole lesson. By the look of things the problem was too obvious, but it unnecessarily consumed a lot of time which could have been used profitably. In fact, the learners could have been asked to identify an angle, and then provide a reason for the answer verbally, instead of writing sentences on the board.

The nearby classrooms were a bit noisy, perhaps the teachers did not turn up for the lessons. The students from another class were heard passing by and it seemed that, their noise captured the attention of some students.

The teacher interrogated the student who got the wrong answer but the student appeared to be confused and decided to leave the board. The teacher asked the student to get back to the

board to correct the answer. The teacher guided the student with some probing questions until he got the correct solution. The bell rang at 11:45am.



12:33 Maths lesson Grade 8. The same teacher

The seating arrangement was the same as in the previous lesson.

The students were playing outside, but when they realised that the teacher was coming they rushed into the classroom. All the students stood up to greet the teacher when she entered the classroom. Almost all the students seemed to have brought their books, but the teacher used a different textbook. The medium of instruction was supposed to be English but in most cases the teacher communicated in isiXhosa.

The topic of the lesson was equations. The teacher wrote some exercises on the board. After that, she asked the students to volunteer and come to the board and solve each one of those problems. One learner adhered to that, but he struggled to find the solution and was looking for another student to help him. However the teacher intervened to guide the student until he arrived at the answer. In all the solutions that the students came up with, the teacher often asked whether those answers were correct and the response was always “yes”.

In the meantime, there came another teacher who stood at the door and beckoned the teacher to come over. They had a conversation for quite some time. While they were still talking, the learners made a lot of noise. The student’s solution

Some students from the nearby classes were seen outside, apparently the teacher did not attend the lesson.

It appeared that, for most of problems given, students were required to solve them on the board. The students were given an exercise towards the end of the lesson. Hence, the teacher was not able to see the students’ individual works. While they were doing their work, it seemed that some students were assisting one another to arrive at the correct solutions. Apart from that students were sharing equipment such as rulers, pens, etc. Often, students were seen throw them from one side to the other.

The bell rang at 12:15

Appendix 6

OBSERVATION NOTES

16-08-2011

I arrived at a school at 9:45am and I had a chance to go around the school premises. The classes were generally calm and no students were seen wondering outside, except the students who were at the sports grounds. One non-academic staff told me that, every class has a sports period twice in a week and there is an instructor who monitors them.

During the break time which started at 10:10am, the students were playing at the sports grounds. All the students were in their proper school uniform.

The staffroom looked big enough to accommodate over forty teachers. Some teachers who were present in the staffroom were busy preparing for the next lessons; some were having their breakfast, while other who clustered in a group of five had a conversation which was conducted in Afrikaans.

From the open discussion interview with one mathematics teacher, I gathered information pertaining to how the teacher thought about his students. He indicated that most of the students do not take responsibility on their learning. He added that, the students only get serious on what to learn “if it mattered” especially when it comes to the scoring of good marks in the examinations. He said that if the teacher would say, “this one is going to appear in the exam, 15 marks guaranteed”, it is then that the students would show some interest by putting more effort in trying to understand such kind of a problem, and they would consult the teachers. He also stated that in the midyear exam, students don’t show a lot of interest towards what they learn because they know that they can still make it if they could be focused towards the end of a year. Moreover, he pointed out that, a lot of interest is shown towards the end of year exam, because they know very well that it determines whether they proceed to the next Grade or not.

Life orientation Grade 11

At 10:40 the bell rang to signal the start of the next lesson. All the teachers in the staffroom immediately went into their respective classes. The students as well went to the classrooms immediately and they were also seen queuing outside the class waiting for the teacher to enter the classroom first. After the teacher had entered, one boy asked whether they should enter into the class. In replying, the teacher indicated that they were allowed to do so. When they entered the class they remained standing and quiet waiting for the teacher to greet them first. In return, the students greeted the teacher and the researcher (i.e. myself). After that they sat down, and the teacher introduced me to the students. He reminded them about other researchers who visited that class recently. He also made them aware about a series of visits that were still coming of the research students of various universities, coming from different countries, such as America, Japan, England, etc. From their remarks and facial expressions, it appeared that the students were impressed with that. The number of students that were in class was around 40s, and the classroom did not look congested.

The teacher was seen in the front position of the class most of the time. He did a lot of talking while the students remained seated and they were absolutely quiet. Perhaps, they were listening

carefully. Among the things that he was telling the students was that every one of them has a potential to succeed academically. He emphasized the point that each one of the students should not undermine themselves because all of them are geniuses. The talk too about 10 minutes and the students were not granted an opportunity to ask questions, neither were they given a chance to give their own opinions with regards to what the teacher had just said.

Afterwards, the teacher read a passage from the handout. He then posed a series of questions based on the issues that emerged from the passage. Most of the questions were addressed to the entire class, and the students in return often answered in a chorus. It was in a few occasions that the teacher called the students by names, inviting them to answer individually. In those few occasions the students who volunteered to give answers were all boys. It appeared to be a routine, for the students to stand up before they could give answers individually. Thereafter, the teacher distributed the handouts which entailed a task. The students were requested to work in pairs. When the learners began with their work a bit of noise was heard, but it was fairly reasonable. Most students communicated in English when completing the task, except the two boys who were not seating far from where I was positioned, who also communicated in English and sometimes they switched to Afrikaans.

The medium of instruction was definitely, English throughout the lesson. While the students were doing their task, the teacher interacted with some individual students moving, who often raised up their hands indicating that they seek assistance. However, the teacher was not seen moving around to check the progress of the rest of the class. Even though, the students were requested to work in pairs, it appeared that different groups exchanged the information/ideas.

At 11:21 am, the intercom was heard requesting the teacher to report into the principal's office. I then left the class with the teacher at 11:26am.

General information

There were posters on the walls which made awareness about the dangers of the drug and substance abuse.

The students were generally disciplined.

Grade 8 mathematics

I arrived at the class towards the end of a lesson. At that time the teacher was not actually teaching, but she projected the computerized audiovisual steps for solving algebraic problems. Most students at that time were not concentrating on what was happening on the board. The class was a bit noisy, but the teacher tried controlled it. At 11:34am the bell rang and the students stood up immediately not waiting for the clip to come to an end. They remained standing until the teacher greeted them, and gave them permission to get out. When moving out of class, students did not flock at the door, but the teacher controlled their movement by calling the row which had to move out. The students in each row made queues, when waiting for their row to be called.

Grade 8 financial mathematics

At 11:37am another group of Grade 8 students entered the classroom. In their arrival, they stood up until the teacher had greeted them. After that the teacher requested them to greet me, which they did with respect. After that she requested them to seat down. She then introduced me and informed them about my purpose of being there.

The teacher stood in front of the class when teaching. She requested one student to lend her the blazer and she hanged it at the window. It appeared that the teacher wanted to demonstrate something with it. Even though, the examples that the teacher was using referred to the buying price and selling prices of blazers, I could not understand why she needed to display the blazer in front of the class. When she posed a question, some students tried to chorus the answer, but the teacher stopped them and requested them to put up their hands, if they knew the answer. Afterwards, most students raised up their hands, and the teacher choose one at random to give the answer. Apparently, the manner in which the teacher asked the question was encouraging the choral response. Her question was asked this way: “What should we do in order to find the amount of profit made for selling a blazer?”

After making an example, the teacher projected the slides of notes on the board. While the students were still writing the notes, the teacher asked them whether they understood what they had been taught, and no one said he/she did not understand. She repeated the question and said, “Who does not understand, so that I would him/her”. Again, there were no students who showed up to have some problems. When students finished copying some notes, she projected the exercise questions on the board and she requested students to work individually. She once again said that those who did not understand should put up their hands, so that she could help them. The teacher did not move around to check learners’ work.

After 3-4minutes, she requested a volunteer to go and solve the first question on the board. One girl volunteered to do the problem. The teacher asked her to explain what she was doing. The student successfully put into words every step that she was doing, but she did not necessarily provide reasons about why she was doing so, neither was she interrogated to do that.

One boy was asked to solve the next problem on the board and he also narrated the steps that he was performing, the previous girl. Initially, the boy wrote $R60 - R80 = R20$ - instead of $R80 - R60 = R20$

The teacher told him to identify the selling price and cost price. It was then that the boy wrote what was expected.

Another student volunteered to do third problem and he managed to get the correct answer, and he described what he did in every step. In fact the first problems were of the similar format (i.e. all of the questions wanted students to calculate the percentage profit given both values of the cost and selling prices.

The fourth problem was slightly different from the previous ones because it required students to find the parentage loss. When the teacher requested students to volunteer for solving a problem, no one seemed to be ready to do that. It was then that the teacher called one boy by the name inviting him to solve the problem. The boy did not resist, and went to the board. However, he appeared to have no clue of what to write. When the teacher realized the student was struggling, she invited one girl to go and help the boy. Unfortunately, both of them were not able to get the correct answer. While they were busy trying to make sense out of the question, one boy made a suggestion that students they should just divide those values. Other students laughed at him, but the teacher reprimanded those who laughing. She then requested the boy to explain why they should divide those numbers. However, the explanation he made did not make sense. The teacher asked several students to give suggestions for answering the question. Ultimately one girl came up with the correct answer.

The teacher gave another exercise which was in the students textbooks. The teacher kept on repeating that whoever didn’t understand should put up his/her hand. By the time the teacher moved around, she came across one student who had finished doing the first question. She

immediately invited that student to solve the problem on the board. However, she did not give students enough time to finish solving the problem, hence she only checked the work of two or three students, while the work of the rest of class, remained unchecked. I should make it clear that the teacher was not marking the students' books. When the student put the answer on the board, the teacher realized that it was incorrect, and the student looked a bit confused. The teacher then requested other students to come up and help that student. The solutions of those students were also incorrect. The teacher asked the whole class whether the answer was correct or not, the whole class said "yes" and the teacher accepted the students' response, they moved to the next problem. Either the teacher did not pick up the mistake or she realized that the problem was a bit tricky and perhaps she also did not know how to solve it at that point in time, hence why she made a decision to move on to the next problem.

The teacher requested the students to volunteer for doing the next problem. She then called one girl by the name to come up on the board. The girl was not able to anything on the board. After that, the teacher asked other students to join in for assisting that girl to get the answer. The answer was also incorrect. The teacher posed the same question regarding the correctness of the answer, and the obvious response from student came up as: "yes". The teacher accepted the answer, and then moved on to the next problem.

One student asked for permission to go outside, and the teacher allowed her to go out. The student came back within two minutes.

While the students who the teacher requested to solve the problem together were still busy on the board, the bell rang for the second break (12: 27pm). Suddenly, all students stood up and waited for the teacher to greet them. Afterwards, they made queues and the teacher let them out according to their respective rows. However they left the problem unsolved, and the teacher made no comments with regards to that.

General information

Generally, the teacher did not go around checking every learner's work. It appeared that she was only interested for the learners to solve lots of problems as much as they could.

She only had exposure on the solutions that appeared on the board. Of course some solutions were freely accepted as correct whereas they were not. In fact, there was no marking of books that took place for the entire lesson.

The classroom had an overhead projector, a computer and the speakers.

There were mathematics and science posters on the walls

Medium of instruction was English

The class was not crowded, and the total number of students was about 35.

After the lesson, the teacher indicated that she was new in teaching mathematics as she previously taught life orientation.

Grade 9 mathematics

The bell rang at 12:52pm and the teachers leave the staffroom immediately; and outside the students were seen going to the classes. At 12:55pm, almost all the students were queuing at the doors of the classrooms. Similar to what I observed in the previous classes, the students stood up before the teacher had greeted. The teacher asked them to greet me, after that she introduced me to the students. 2 to 3 minutes three boys entered, the teacher fiercely asked them where they come. But she allowed them to seat down.

When the lesson was about to start, the intercom was heard requesting the teacher to release one boy so that he should report in to the principal's office. The students made some remarks that indicated that the boy was really in a serious trouble. 2 minutes later, the intercom was heard again asking the teacher whether the boy was still coming. The teacher told the principal that the boy had already left.

There was another boy who was seated at the back, he was making some noise. The teacher transferred him to the front desk. He then became quiet. Later on, the boy who was called by the principal entered the class, and the teacher asked him whether he was really from the principal's office.

The lesson started at about 1:07pm. The topic was on the polygons.

Most of the time, the teacher was seen in front of the class and she was addressing questions to the whole class. In return, the students often responded in a chorus. After doing an example on the board with the students, the teacher read question at the same time students had to write them down. That appeared to unnecessarily consume some time. She stated that she would be marking the exercise that she had given in the previous day, while students would be working the exercise that she had just given them. She further said, "While I will be marking your books, I don't want to hear your voices, unless you will be asking for something."

The class was fairly quiet, there were still some students who communicated and it appeared that there were sharing some information on the exercise that they were given. Perhaps some of them did not pick up some words when the teacher was reading the question or maybe they were helping one another for finding the answers, even though they were expected to work individually.

One girl appeared to be sick and she went to the teacher asking for permission to go out. The teacher wrote something on the piece of paper and she gave it to the student who then walked out. Afterwards, the teacher continued marking the books. When she heard any kind of noise, she quickly managed to stop it. Some students were seen sharing some equipment such as rulers, rubbers and textbooks. The teacher urged students to bring along the textbooks, stationery and the mathematics sets in every school day. It appeared that one boy had not brought the stationery, and was doing nothing except making some noise. The teacher threatened him by saying that she would take him to the front desk. It was then that the student stopped making noise anymore.

After marking the students' books, the teacher asked them to copy some notes which she had written on the board.

At bell rang at 1:42

While the students tried to stand up, the teacher asked them to first finish copying the notes before they could leave class. Afterwards, the teacher greeted them and asked them to leave the class, and they did so in the similar manner as the classes that I observed earlier.

General information

The seating arrangement is the same in all the classes that I observed.

The medium of instruction was English throughout the lessons.

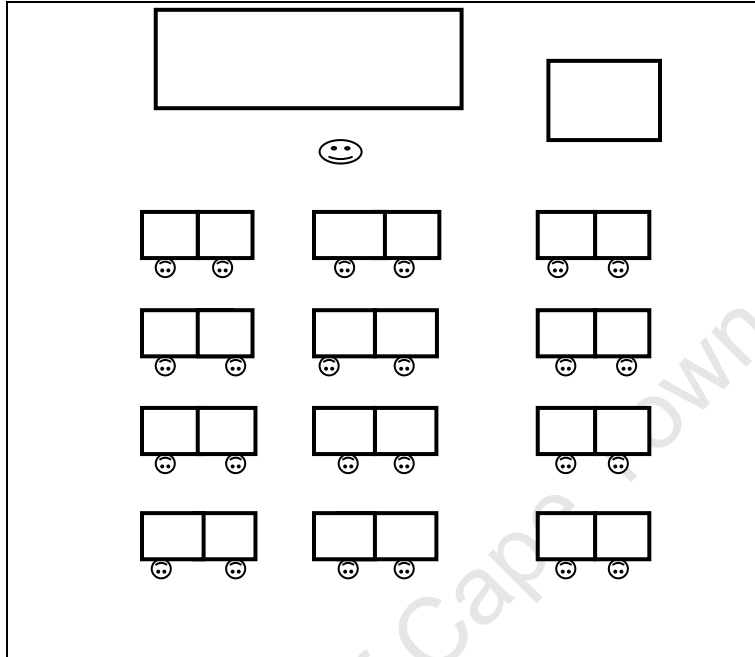
There were biology posters on walls of the classroom

The number of students in the class was around 30s

The Grade 11 Life orientation teacher told me that they receive a lot of applications for Grade 8 enrolment from all over the city, because of the good reputation of the school presently. When talking about the students, he indicated that they no longer have disciplinary problems from students in the school. He further stated that the school was once dysfunctional and had

disciplinary problems relating to drugs and *gangsterism*. Talking about his Grade 11 students, he told me that it was one of the disciplined and dedicated groups. Seating arrangement appeared to be the same in all classrooms.

Seating Plan



Appendix 7

TRANSCRIPTS OF GRADE 9 MATHEMATICS LESSONS IN FIVE SCHOOLS

[School P1 Lesson 1]

TIME	#	Speech	Comments
00:00	1.	Teacher: ... [Inaudible] outside and he still continues. ... I'm waiting to greet. Stop this order, go and sit down. You're here the entire day to drink, I told you not to drink in class. ... I'm waiting. ... Good morning class.	
	2.	Learners: Morning sir.	
	3.	Teacher: Let's sit down and take out our maths books. ... I don't want any talking. Sit down and take out your maths books. ...	
01:00	4.	Learners: [Inaudible] [Activity and noise, teacher watches as he waits for the class to settle.]	
01:13	5.	Teacher: <u>Ukabayasi</u> . {Translation required} {I'm going to hit you}? ... [Cleans board.] ... I'm still waiting. I'm waiting. ... Alright. We are still busy with exponents [02:00] as we did last week. Alright?	
02:02	6.	Learner: Yes, sir.	
	7.	Teacher: And I very kindly asked you guys to take down the questions that you got from the computer, ... from the [inaudible] maths, okay? And this is what I'm gonna do. After I'm finished with these rules, I'm gonna ask you to give me those questions back. We'll have to discuss them in class, as a class, as a whole. Because some of the questions that came from that are things that we have not yet done in class and I said I'm going to explain them. Alright? Now let me finish up with the rules. ... Law number one, you say that if you have a to the m times a to the n . What answer do you think we should get?	02:54 Board Shot
	8.	Learner: A plus m .	
	9.	Another Learner: A and m plus .	
	10	Teacher: It's a , the same base, [03:00] m .	
03:01	11	Learners and Teacher: Plus n .	03:02 Board Shot
	12	Teacher: That's what we said, isn't it?	
	13	Learner: Yes sir.	
	14	Teacher: So if I give you an example, say you have seven to the power minus four ... and I say we multiply it with seven to the power of two. We say keep the bases as it was. It's seven. And you add up your exponents to find the sum of that which is minus four plus two. That's what we said, isn't it?	
	15	Learners: Seven [Inaudible].	
	16	Teacher: And this is the step that I said I'm interested in. I'm not really looking for the answer. I'm really looking into the methodology. How you got your answer. And we said it's gonna be seven. What is minus four plus two?	

- 17 Learners: Minus two.
- 18 Teacher: It's minus two. That's what I want, okay? This step is very crucial to me because it tells me what you are doing. That you give me this is not that much important. Yes, it is the answer but it's not that much important. I'm interested in this. How do we get that? We find the sum of them. Okay. I can make it er er er a variable. [04:00] I say it's x to the power of minus b and I say multiply it with x to the power of y . What do you think should be the answer?
- 04:08 19 Learners: X minus .. x ... x .
- 20 Teacher: It's x , the same base, you keep the base, it's ...
- 21 Learners: Minus b plus one.
- 22 Teacher: Brilliant guys, that was law number one. Okay, let us quickly run through law number two. We said it's the opposite of that, the reverse. If you got a to the power of m , you divide it by a to the power of n or I can write it in this format: a to the power of m divided by a to the power n . In this manner...
- 04:25 Board Shot
- 23 Learner: That is how we did it.
- 24 Teacher: ...it looks as a fraction. In this one it looks in the classical division way. What should we do? It's a , we keep the base again.
- 25 Learners: m minus n .
- 26 Teacher: It's m ...
- 27 Learners: Minus n
- 28 Teacher: ... minus n which means we take the difference. Alright? We could do the same in this fraction manner. We write a into m minus n . That was law number two. And I can give examples as well. I say two to the power of four [05:00] divided by two to the power of one. Okay, two divided by one. Okay. What should be the answer?
- 05:07 29 Learners: Two and four minus one.
- 30 Teacher: Minus one and the final answer is?
- 31 Learners: Two to the power of three.
- 32 Teacher: Two to the power of three and you can simplify it and simply write it as eight. It doesn't matter. I'm not really looking to that. I'm looking for this step which is the difference. Let me play around and make it a bit more complex. I say, I've got three to the power of seven, divided by three to the power of eleven. What should be the answer?
- 05:22 Board Shot
- 33 Learner: Three over minus four.
- 34 Another Learner: Three to the power of minus four.
- 35 Teacher: It is three to the power of seven?
- 36 Learners: Minus eleven.
- 37 Teacher: Minus eleven.
- 38 Learners: Gives three to the power minus five ... minus four.

	39	Teacher: It's three minus four. Okay. We are gonna simplify this if they tell you to write it as a positive exponent, we'll do that later but for now let us just arrive at the answer. Okay. [06:00] What if my denominator was negative? What would I do if it was negative? ... We are still applying the basic rule over there. What would I do if it was negative? I'm gonna give you an example. ... It's x to the power of four, divided by x to the power of minus three. ... Is there anybody who's quite confident now?	06:03 Board Shot
06:28	40	Learner: x four minus three.	
	41	Teacher: It's x four	
	42	Learner: Minus three	
	43	Teacher: Minus	
	44	Learner: Three	
	45	Learners: Minus, minus three	
	46	Teacher: Minus, minus three. Remember we subtract the denominator. The denominator is supposed to be negative. Alright? So what should we do now? It's x four	
	47	Learner: Four	
	48	Teacher: What is a negative times a negative	
	49	Learners: Plus three ... plus	
	50	Teacher: It's plus three ... which is x seven. ... Are you still with me?	06:56 Board Shot
	51	Learners: Yes, sir.	
	52	Teacher: Okay, that was law number two and now from today we need to be starting from here. [Cleans board]. ... Okay. ... The focus for today, we are gonna do two of the laws of exponents. Law number one it says, if you've got a to the power of n ... that will be law number three. And law number four for today, it will be a to the power of zero.	
07:00	53	Learner: Sir, sir.	07:35 Board Shot
	54	Teacher: We've done this, ... we've done this on the computer. A to the power of zero, we should get one. ... A to the power of m times n . It's a m times n . If you get two powers...	
	55	Learner: Sir	07:50 Board Shot
	56	Teacher: A to the power of m , to another power of n , what should we do? I'll be with you. I see your hand.	
	57	Learner: Sir, is that a new law that we're doing?	
08:00	58	Teacher: Yes, these are the rules that we are gonna do today. Okay? We're saying we have a to the power of m ... and not only to one power, there is another power outside the bracket. What should you do? You keep your bases, you did previously. What do you do to your powers? You multiply your powers. We can rewrite this as a to the power of mn You multiply the powers. Now let us do some examples. Can you take this down please guys?	
	59	Learners: We have that down. ... we have that down.	08:27 Board Shot

- 60 Teacher: Okay. So if we have three to the power of four, to the power of five. What should be the answer there?
- 61 Learners: Three ... [inaudible] it's four times five ... [inaudible] to the power of ...
- 62 Teacher: It's three.
- 63 Learners and Teacher: Four times five.
- 64 Teacher: Which is three to the power of twenty. ... Alright. Daniel, this question is for you. [09:00] What if I had two to the power of two and all to the power of a half. What should be the answer there?
- 65 Learner: Two.
- 09:10 66 Teacher: It's two, we keep the base.
- 67 Learners: Then it's two times ... times ... a half
- 68 Teacher: It's two times.
- 69 Learners: A half.
- 70 Teacher: A half.
- 71 Learners: [Inaudible] five
- 72 Teacher: It's two. What is two times a half?
- 73 Learners: One.
- 74 Teacher: It's one. Therefore our answer is one. So two to the power of one is two.
- 75 Learner: It's two.
- 76 Teacher: Sorry
- 77 Learner: Yes
- 78 Teacher: Are we happy about this?
- 79 Learners: Yes, sir 9:36
Board
Shot
- 80 Teacher: Now let me change it and make it a little bit negative. I've got x to the power of y times z . What should be my answer? That gentleman.
- 81 Learners: It's x
- 82 Teacher: It's x
- 83 Learners: Y times z .
- 84 Teacher: So I can play around with these, make some variables. ... [Speaks to learner at the door. [10:00]] ... Okay, now I'm gonna do an exercise on this one alone. I'm gonna give you some questions for you to try on your own. [Cleans board and writes.] ...
- 85 Learners: That's three times. ... [Inaudible] ... that's the answer there then [inaudible] A pen please 09:54
Board

			Shot
10:12	86	Teacher: You come to class without a pen? Use your pencil then. Samson, I'm waiting for you. [11:00] [Writes on board.] ... Let's do those three. I'll be walking around and looking at your work.	
11:42	87	Learners: Sir	11:36 Board Shot
	88	Teacher: Question number one, it's xyz to the power seven, all of it to the power seven. Question number two, three x squared, all to the power of three. Number three, [12:00] it's a half xy , all to the power of two and number four, it's minus three x divide by y squared, all to the power of three.	
12:13	89	Teacher checks students' work. [13:00]Very good. It's xyz , all to the power of seven. If there's no power indicated to you, class, what power is there?	12:23 Board Shot
13:43	90	Learners: One.	
	91	Teacher: It's to the power of one. ... So if there's no power written, we should probably know that in the back of our minds. The power is one.	
14:00	92	Teacher: [Leaves room. The bell rings and he closes the door as he enters.]	
	93	Teacher: [Checking learner's work]. What is the power of x ?	
	94	Learner: [Inaudible]	
	95	Teacher: What is the power of y ? What is the power of m ? (Word unsure). What is one times seven?	
	96	Learner: [Inaudible]	
	97	Teacher: [Inaudible] [15:00]	
15:09	98	Teacher: Class, I don't like that. Don't copy questions. You know that. I hate it. Pick one question that you are comfortable with and answer only that question. You see, most of you, what are you doing? They are copying one to four and you leave them blank. You know I hate that. Pick one that you are comfortable with then answer it.	
	99	Learners: Sir.	
	10	Teacher: Don't say yep. ... [Inaudible] ... [Checking learner's work] Three to the power of one. What is three to the power of three? Three times three times three. What is it?	
	10	Learners: Must I write [inaudible] like that?	
	10	Teacher: Yes. It's a half to [16:00] the power of? [Inaudible]. [Checks other learners' work.]	
16:37	10	Learner: Three.	
	10	Teacher: That's correct. [Inaudible]. ... [17:00] ...	
17:03	10	Learner: Sir?	
	10	Teacher: ... I'm coming to you. Yes, you have to do your [inaudible]. What is three to the power of eight? [Inaudible]. What is two to the power of two?	
	10	Learners: two times two	
	10	Teacher: What is three to the power of four? Three times three times three times three? What does three to the power of three mean? What is three times three times three? Three times three is what? Nine times three is? Nine times three?	

- 10 Learner: Twenty-seven
- 11 Teacher: Twenty-seven. So three to the power of three is? Twenty-seven. That's [inaudible]. X equals. ... You've long called me. This is not right. [18:00] Let's start from scratch. It's x to the power of? Y to the power of? And zed to the power of one. Why do we say that? If there's nothing reading, it means that the power is one. Okay? So [inaudible]. Now let us do this. All of these are to the power of seven. You say you have to multiply each. It's x to the power of one times seven, y to the power of one times seven, zed to the power of one times seven. What is x , one times seven?
- 18:37 11 Learners: X , seven
- 11 Teacher: X seven. One times seven? Zed. One times seven? That's your answer. Was that difficult? Three x squared, all two. What should you do? Each of them is going to be three to the power of one. X to the power of [19:00] two. What does this mean? It's three y so it's two. One times three? Times x , two times three. What is one times three? What is two times three? What is three to the power three? X to the power of six. Is that difficult?
- 19:26 11 Learner: No sir.
- 11 Learners: Sir, here, sir.
- 11 Teacher: He has long called me. I'm coming there. ... This is not right as well. This is not right as well. ... How can I do them [inaudible].
- 11 Learners: [Inaudible].
- 11 Teacher: All of them are wrong. We are gonna do it on the board as a class. [20:00] Huh uh, huh uh I don't want that. You should be finish if you need to talk. Okay. Come, let's do this together. I've seen some few of you guys. Alright. According to this, we know that if there's nothing that reads, all the powers are?
- 20:17 11 Learners: One.
- 11 Teacher: Ja {Yes}. Okay. We haven't done anything yet. We are just rewriting the question. Okay, now we can start applying law number three. It says, if you've got a power and another power; what should you do to the powers?
- 12 Learners: Times it.
- 12 Teacher: Multiply. One times seven. Do you all agree?
- 12 Learners: Yes, sir.
- 12 Teacher: And then you've got y , one times seven and zed, one times seven. Which is, one times seven is?
- 12 Learners: Seven.
- 12 Teacher: Seven. ... [21:00] Okay? ... Now let's come to the next one. ... Thompson, what should we do? 21:00 Board Shot
- 21:12 12 Learner: Sir, we should plus the powers [inaudible] so it's gonna be, three to the power one times three.
- 12 Teacher: Three to the power of one times three. So although it's not reading, we know that it's three to the power of one x .
- 12 Learners: X two times three.
- 12 Teacher: I said Thompson. Can we give Thompson a chance.
- 13 Learner: X squared times three.

- 13 Teacher: X squared times three. Alright?
- 13 Learner: And then it's three to the power of three.
- 13 Teacher: It's three to the power of three.
- 13 Learner: And then x to the power of six.
- 13 Teacher: X to the power of six. That's fine. We can simplify it if we want. What is three to the power of three?
- 13 Learners: Twenty times [inaudible].
- 13 Teacher: It's three times three times three which is twenty-seven and to the power of six. That is correct. [22:00] Now I would like that gentleman to help us with the question now. We're gonna help you but you're gonna initiate. Can you help us? Okay? Just the interpretation of that question we're asking for. What should we do?
- 22:19 13 Learner: A half, sir.
- 13 Teacher: Huh?
- 14 Learner: One half.
- 14 Teacher: It's a half.
- 14 Learner: Times ... one times two.
- 14 Teacher: Yes.
- 14 Learner: Then we um, put an x .
- 14 Teacher: Uh huh.
- 14 Learner: One times two.
- 14 Teacher: One times two.
- 14 Learner: Which equals to one.
- 14 Teacher: I'm lost? Tell me? ... Yes? We've done this one, we've done that one. Daniel, over to you. ... We've done this one, [23:00] we've done that one. Yes?
- 23:03 15 Learner: [Inaudible].
- 15 Teacher: Y
- 15 Learner: Um ...
- 15 Another Learner: One times x .
- 15 Teacher: Okay. Back to [inaudible].
- 15 Learner: One times two.
- 15 Teacher: It's one times two. Okay, let us rewrite this. It's a half. What is one times two?

- 15 Learners: Two.
- 15 Teacher: It's two. We haven't done anything yet. And then x .
- 15 Learners: It's two.
- 16 Teacher: It's two.
- 16 Learners: Two.
- 16 Learners: Y .
- 16 Teacher: Alright, my focus is here. We've been applying the principle for all of these to say it doesn't matter what each of those reads. All you need to do is, we apply that principle to each of them. Are we clear about that? Because that is the important thing that we're doing. Even here, [24:00] even if it's a fraction. Even if it's a negative constant. It does not matter. The important thing is we take that and we multiply it with it's power. Is that clear? That is the important thing. Okay? Now let us move on. What is one to the power of two?
- 24:18 16 Learner: One.
- 16 Teacher: It's one. What is two squared?
- 16 Learners: Four.
- 16 Teacher: It's four. We've done this before. X squared, y squared, okay. We will get back to this again. Alright, now let us come to the last question. ... Anybody who is willing to help us? Right, you're going to try.
- 16 Learner: Minus three.
- 16 Teacher: It's minus three.
- 17 Learner: To the power of one.
- 17 Teacher: To the power of one.
- 17 Learner: Times three.
- 17 Teacher: Times three.
- 17 Learner: X .
- 17 Teacher: X .
- 17 Learner: To the power of one.
- 17 Teacher: One.
- 17 Learner: Times three.
- 17 Teacher: Times three.
- 25:00 18 Learner: Y to the power of

- 18 Teacher: *Y*
- 18 Learner: To the power of two.
- 18 Teacher: Two.
- 18 Learners: Times three.
- 18 Teacher: Times three. Brilliant. Okay. Alright. What should you get here?
- 18 Learners: Three.
- 18 Teacher: Let's allow him to complete.
- 18 Learner: It's three.
- 18 Teacher: And?
- 19 Learners: Three. ... Six.
- 19 Teacher: Six. What is negative three to the power of three? And I've shown you a method of doing it. Now let me leave it for you, [inaudible]. Somebody else would like to try this? A negative three to the power of three. We did this. ... He says twenty-seven. Is he right? 25:32 Board Shot
- 19 Learners: Yes. .. [inaudible] No .. It's minus twenty-seven
- 19 Teacher: Okay, can you prove to him that it is minus twenty-seven? Show him that it is minus twenty-seven. [Cleans board and writes.] ... [26:00] There's something that we did in class. Yes? Who's that? Minus three to the power of three is minus twenty-seven
- 26:16 19 Student writes on board
- 19 Teacher: Alright. I'd like this gentleman to go help him. Go and whisper at his ear. Help him. See if you can discuss amongst you, the two of you. Why do we get minus twenty-seven? I'll ask the third person to go and help them. Go and help them. The three of you are going to discuss why you should get minus twenty-seven.
- 19 3 Learners: [At board]. [Inaudible] [27:00] three times three ... three times ...
- 27:07 19 Teacher: Alright. You guys as groups, can you discuss amongst yourselves. I'll be walking around. You try to convince me in your books why you should get minus twenty-seven.
- 19 Learner at Board: Isn't this right, sir?
- 19 Teacher: Um. ... You made some little mistake.
- 20 Learner: Little mistake?
- 20 Teacher: Go and find it, go and find it.
- 20 Learners: [inaudible].
- 20 Teacher: This gentleman has got it right. ... [Checks learners' work]. ...
- 28:00 20 Learners: [Inaudible].
- 28:15 20 Learner at Board: [To seated learner] Who asked you? ... Who asked you?

- 20 Learner: Sir?
- 20 Teacher: [Inaudible].
- 20 Learners: [Pushing each other at board] Sir.
- 20 Teacher: Hey, hey, hey!
- 21 Learners: Laugh [Inaudible].
- 21 Teacher: Huh uh, huh uh. Sampson, the concept is correct. Now convince me from that. Why we are getting minus twenty-seven.
- 21 Learner: Why?
- 21 Teacher: Why are we not getting positive twenty-seven? Why are we not getting 100? Prove to me.
- 21 Learners: Sir
- 21 Teacher: No, no, no you do it. I'm walking around.
- 29:00 21 Learners: [Inaudible] [Class very noisy].
- 21 Teacher: [Marking learners' work]. Look at your [inaudible] positive. Why are we not getting positive twenty-seven?
- 21 Learners at Board: [Inaudible].
- 21 Teacher: [Inaudible] ... positive twenty-seven.
- 22 Learners: Shut up! [Inaudible] Wait, keep quiet! Leave it. Leave it! [Inaudible]
- 22 Teacher: [Inaudible]. Minus twenty-seven. But why are we getting minus twenty-seven?
- 22 Learners: Sir? [Inaudible] Sir? Move! Move! Move! Sir? Wrong, sir? Almost there. [30:00] Shh, man! It's right, sir? Yeah! We're finished now, sir? 29:56 Board Shot
- 30:07 22 Teacher: Okay, let us do it together as a class. We've done this. We have done this. Alright, class. Pay attention, please. Young man. ... Okay, let us do it as we did it before. Guys, I keep on saying the things that we've done in grade eight and grade nine, it's so amazing, when you get to grade twelve, you don't even know what cube means. We have said, it means it's minus three times minus three. How many times?
- 22 Learners: Three times.
- 22 Teacher: Three times. Okay. These gentlemen were correct, okay. Now let us prove that they were correct. What is minus three times minus three?
- 22 Learners: {Inaudible}.
- 22 Teacher: What's a negative times a negative?
- 22 Learners: Nine. Nine. A positive nine.
- 31:01 22 Teacher: It's a positive nine.
- 23 Learners: Then a positive.

- 23 Teacher: What's a positive nine times a negative?
- 23 Learners: A negative. A negative twenty-seven.
- 23 Teacher: A negative twenty-seven. Okay. Alright, okay, let me do it the other way. What is a negative times a negative? 31:13 Board Shot
- 23 Learners: A positive.
- 23 Teacher: What is a positive times a negative?
- 23 Learners: A negative.
- 23 Teacher: It's a negative. Three times three times three is? Twenty-seven. So we know our answer is going to be negative. This is what we're saying; if your power is odd ...
- 23 Learners: Odd, yes
- 23 Teacher: If I can write minus two to the power of seven, you don't even need to think. Why? Because your power is odd. So which means your power is going to be negative. Sorry, it's going to be negative. What if I give you a hundred to the power of one thousand and one.
- 24 Learners: It's going to be positive. Negative. Negative. Negative.
- 24 Teacher: Negative number. Why?
- 24 Learners: Odd number. It's an odd number.
- 24 Teacher: The power is odd. Please remember that.
- 24 Learners: Or even.
- 32:00 24 Learners: [Inaudible] Shut up. Shut up. [Inaudible].
- 24 Teacher: Alright. Sampson, Sampson, please. Hello guys, huh uh, huh uh. ... Okay, we've said, you know you'll get a negative twenty-seven, x cubed minus y six. But remember, I said this is not really important to me. What is important is how you got that answer. It's minus three to the power of three. That's what is important to me. The meaning to the rule. Okay? ... What if I give you something like this. [Writes on board.] ... [33:00] ... What have you got? Let us add those to our questions. What would you do if you had a negative power? ... What would you do if you had a negative power? 32:42 Board Shot 33:05 Board Shot
- 24 Learners: Plus sign,
- 24 Learners: Plus,
- 24 Learners: Plus minus, sir,
- 25 Teacher: Okay, let's get back to the basics. What does the rule say?
- 25 Learners: Plus minus, sir,
- 25 Teacher: What does the rule say?
- 25 Learners: X times,

- 25 Teacher: What does the rule say?
- 25 Learners: [Inaudible].
- 25 Teacher: No, no, no, let us not get concerned with the answer. I'm not interested in the answer. What does the rule say? If you've got a power over another power, what should you do?
- 25 Learners: Times.
- 25 Teacher: Multiply. So what should you do?
- 34:00 25 Learners: Multiply.
- 26 Teacher: Multiply, so what are we gonna get?
- 26 Learners: X .
- 26 Learners: Plus.
- 26 Learners: Minus one plus two.
- 26 Learners: Minus one times two, sir.
- 26 Teacher: What is minus one plus two?
- 26 Learners: Minus two.
- 26 Teacher: Minus two. Okay, so you can play around guys and change things but remember to keep the principles. Okay, let us come to this one. What should we do again?
- 26 Learners: Multiply.
- 26 Teacher: Multiply. Think it in your brain. Think it in your brain. It's y
- 27 Teacher & Learners: Minus two times minus three
- 27 Learners: Equal six.
- 27 Teacher: Y , negative times a negative is six. Plus six. Okay. The important thing is, if you've got a power over another power, what do you do to the powers? 34:33
Board
Shot
- 27 Learners: Multiply
- 27 Teacher: Multiply
- 27 Learners: Multiply
- 27 Teacher: Now let us come to the next rule. [Cleans board]. ... [35:00] ... [Writes] ... 35:10
Board
Shot
- 27 Learners: [Inaudible]. Is that one oh four, sir?
- 27 Learner: [Goes to board to speak to Teacher] [Inaudible].
- 27 Teacher: [Inaudible] Why? What is it about? [Rest of conversation inaudible].

- 35:56 28 Teacher: Okay guys. ... [36:00] I'm not gonna spend that much time here because this question, I answered it in the computer lab. I'd like some of you, I told you to write at least five questions that the computer asked you. Give me a few of the examples that had the power of zero from the computer. ... Okay?
- 28 Learner: F to the power of zero.
- 28 Teacher: F to the power of zero.
- 28 Learner: Equals one.
- 28 Teacher: Okay. Another one?
- 28 Learner: Y to the power of zero.
- 28 Teacher: Y to the power of zero.
- 28 Learner: Equals zero.
- 28 Learner: Sir, it said a divided by y to the power of zero.
- 28 Teacher: A
- 29 Learner: Divided by y
- 29 Teacher: Divided by y to the power of zero. Like that. Okay, a different one?
- 29 Learner: X to the power of zero, sir.
- 29 Teacher: X to the power of zero, yes.
- 29 Learner: Y multiplied by zero.
- 29 Teacher: D is? ... D divided by?
- 29 Learners: Brackets, divided by m .
- 37:00 29 Teacher: D divided by?
- 29 Learner: M ... to the power of nought.
- 29 Teacher: To the power of zero. It seems like it's right as well. ... Okay. Can I get more examples?
- 30 Learner: M squared.
- 30 Learner: One hundred and seventeen.
- 30 Teacher: One hundred and seventeen.
- 30 Learner: And m to the power of?
- 30 Learners: We got that one.
- 30 Learners: Nought.

36:48
Board
Shot

- 30 Teacher: Okay. Another example.
- 30 Learners: [Inaudible].
- 30 Teacher: Uh huh
- 30 Learners: Sir, brackets and then one oh four to the power of, and then close brackets to the power of zero.
- 31 Teacher: Here's an example like that. Yes? ... What if I were to say this. ... This is question number one. three, four. It's two x squared, y to the power of zero. ... It's a to the power of zero divide by one. It's three x , y squared, all to the power of zero. Okay. From the computer we know these are already one, what should be the answer to this one? 38:30 Board Shot
- 38:22 31 Learner: One.
- 31 Teacher: Why should it be one?
- 31 Learners: A over one, sir. A over one.
- 31 Teacher: It's a over one. Why should it be a over one? Let us do it here. We are saying a divided by y to the power of zero is the same as a . What is y to the power of zero?
- 31 Learners: One.
- 31 Teacher: It's one and therefore this a divided by one is? A divided by one is?
- 31 Learners: A .
- 31 Teacher: Itself. Okay. So the answer should be? A . Or you can write it as a over one or eight. Fine. I'm happy with that. What is one hundred and seventeen to the power of zero?
- 31 Learners: Nought
- 38:59 32 Teacher: It's [39:00] one. Why should it be one? But we're saying something that is confusing. One hundred and seventeen to the power of zero is one. Is that true? ... Why is it true? Because the division or the rule says, anything to the power of zero, it doesn't matter what it is; it doesn't matter whether it is a variable, it doesn't matter whether it is a constant but so long as that thing is to the power of zero, it should be equal to one. We are gonna do the proofs of this next year. Why should we say this is to the power of, why should it be one? You're gonna do the proof of that next year. Okay? Alright? What should be the solution to this one?
- 32 Learners: Sir?
- 32 Learner: Two x squared, one.
- 32 Teacher: He's saying, two x squared, y to the power of zero is the same as two x squared times one. [40:00] What is two times one? 40:02 Board Shot
- 40:03 32 Learners: Two.
- 32 Teacher: It's two. We could have just read this as two x squared. Why? Because this thing is one. So anything multiplied by one is that very same thing. This is one. It's only the y that is equal to one. The rest, it stays as it is. Remember, I've said, though it looks like this, the full means you multiply. Two times x squared times one is? Two x squared, alright? ... Let us write the solution. We need two x squared. Now let us come to this one. ... What do you think should be the solution? What should be the solution here? 40:33 Board Shot
- 32 Learner: One over one.

- 32 Teacher: He's saying it's one over one.
- 32 Learner: Which is one.
- 32 Teacher: It's one over one, yes?
- 33 Learners: Equals one
- 41:00 33 Teacher: Which is one, okay? Now let us do the last one. Three x squared, y squared, all to the power of zero.
- 33 Learners: It's three x squared, it's one.
- 33 Teacher: Huh? It's one. Why do you say the answer is one here?
- 33 Learners: Because it's nought to the power.
- 33 Learners: In brackets.
- 33 Teacher: Okay, and now with this one. Guys, can you copy all of these questions? As far as this. We just want to do it using the old method. Do you remember the one that we've just done? Law number three. We are gonna apply law number three to see if we can arrive at the same answer. Thank you [inaudible], go and sit down. ... You know it doesn't lock. ... We are gonna do this one according to law number three and see if we arrive at the same answer. [Inaudible] power over another power. [42:00] ... For this one, I want you to try using law number three. We said, if you've got a power over another power, can we apply that and see if we can arrive that right. ... Remember if there's no power indicated, it's to the power of one. And times zero, one times zero. Right, prove to me that even if we use law number one, we still get this. [43:00] ... You do it in your books. Use law number three to prove that if you do this, you arrive at that. In this case we used law four. We know that anything to the power of zero should give us one. That's what law number four says but what if you applied law three? Will you still arrive at the answer? ... Will you still? 41:42 Board Shot
- 43:29 33 Teacher: [Checks learners' work.] ... 42:12 Board Shot
- 33 Teacher: Brilliant. That is it. ... Where are your questions? 42:42 Board Shot
- 33 Learner: [Inaudible].
- 34 Teacher: Where are the rules questions? Those questions as far as six. And you sit here, don't you know?
- 44:00 34 Bell rings. End of lesson.

[School P1 Lesson 2]

TIME	#	SPEECH	NOTES
00:00	1.	Learners: [Inaudible – very noisy].	
	2.	Teacher: Guys, you need to take off your blazers. I can't teach a class like that. Take off your blazers it's too hot. Jerseys and blazers. ... Go quickly. Let's take off our blazers please and get your maths books. ... Good morning grade nine's.	
	3.	Learners: Good morning Sir.	
	4.	Teacher: Take off your blazers, please.	
	5.	Learners: [Inaudible – very noisy].	
	6.	Teacher: ... [01:00]... Boys, take out your note books please.	
	7.	Learner: [Talks to teacher at the door].	
	8.	Teacher: There are five guys who should go to the [inaudible]. There are five guys who should go to the [inaudible].	
	9.	Learners: [Inaudible]. [Learners very rowdy.]	
	10.	Teacher: ... Quiet. ... [Inaudible] ... [02:00] ... The last time we were together, we were busy with expressions. ... Don't write this. ... [03:00] ... And the last time we spoke about this, the value of the expression. We said the degree of the polynomial is what? The degree of a polynomial is the highest index of that expression. If you're given an example two x plus four x squared minus three x cubed minus four, what would be the degree of this polynomial?	03:07 Board Shot 03:41 Board Shot
03:40	11.	Learners: Three x cubed. Cubed. Three x .	
	12.	Teacher: Put up your one hand.	
	13.	Learners: X . Three x .	
	14.	Teacher: What are you learning?	
	15.	Learner: Three.	
	16.	Teacher: What is the degree of this polynomial?	
	17.	Learners: Cubed. Three x cubed.	
	18.	Teacher: He says it's three x cubed. Is that correct?	
04:00	19.	Learners: [Inaudible]. Yes. It's cubed, sir. X .	
	20.	Learner: It's four.	
	21.	Teacher: He says it's four. ... He also agrees it's four.	
	22.	Learner: Minus four.	
	23.	Teacher: Why do you say it's four?	
	24.	Learners: The highest. It's the highest, sir	
	25.	Teacher: He says it's the highest.	

26. Learners: No, it's the lowest.
27. Teacher: You were saying it's three. Why?
28. Learners: The highest. It's the highest.
29. Teacher: Where is the three?
30. Learners: [Inaudible].
31. Teacher: Will you come and show me?
32. Learner: It's cubed.
33. Teacher: Young man, I'm teaching here, please. ...
34. Learner: [At the board]. [Inaudible] sir.
35. Teacher: That is the three.
36. Learner: Cubed.
37. Teacher: Alright? So I'm saying the degree of this polynomial is three. We look for the highest. What is the power of this? What is ...
38. Learners: One. One. One sir.
39. Teacher: No, this is actually the one that is to the power of one. What is the power of four?
40. Learners: Zero.
- 05:00 41. Teacher: Is x to the power of zero. Why do you say it's x to the power of zero?
42. Learners: Because there's no x .
43. Teacher: Yes, what is the other reason? What other way can we find x to the power of zero? 05:08
Board
Shot
44. Learners: One. It's one.
45. Teacher: It's one. When we are busy with polynomials, when we are busy with indexes, we said x to the power of zero is the same as one, so four times one is still four but we don't write it oftenly, we leave it like that. Similarly as that one, we don't write it but at the back of our minds we should know what the powers of these are. So the highest or the biggest of these indexes, the biggest of that powers is this three. It's greater than all of these are here. Hence we say the degree of this polynomial is three. Guys, you need to go over this at home. ... I can do it but you also have to do your own responsibilities. Now what is the index of the [06:00] ... the fourth term? What is the index of the fourth term? Index also is called the power. What is the power of the fourth term?
- 06:11 46. Learners: Sir, sir. Nought.
47. Teacher: It's nought, it's zero. Why do you say it's zero? Because we can re-write it as x to the power of zero and we are looking at that. So the power of this x , though it's not reading, we say it's zero. Do we all agree?
48. Learner: Yes, sir.

49. Teacher: Just go over what we did last week and now which of those terms, we've got four terms there, which of those four terms is a constant term?
50. Learners: One. Four. Four.
51. Teacher: Okay, somebody else with a different opinion? Sampson? ... The gentleman at the back? ... Alright!
52. Learner: Four.
53. Teacher: He's saying it's four. The constant term is four. Is it four or [07:00] minus four?
- 07:01 54. Learner: Minus four, sir.
55. Learners: It's four, sir.
56. Learners: It's minus four, sir
57. Teacher: It's minus four. Why do you say it's minus four?
58. Learner: Because the minus is there, sir.
59. Teacher: Okay, alright. Do minus you all see it's minus four.
60. Learner: Yes sir.
61. Teacher: Why do you say it's minus four? 07:15
Board
Shot
62. Learners: Because the minus in front.
63. Teacher: Okay, we say each term must go with a sign in front of it. Now, let us look at the co-efficient. The reason why I'm grouping these two is because you guys are likely to make mistakes. Please don't confuse them. What is the co-efficient of the second term?
64. Learner: Four.
65. Learner: Plus four.
66. Teacher: It's plus four. It's plus four. When it's plus, we can leave it as just a four if we choose to, alright? Then the last bit that we went over was the value of the expression. This, guys, is what we did. The last bit was the value of the expression. We also refer to this as substitution. We substitute something. You are given the term there. [08:00] It's two x plus four x squared minus three x cubed minus four and they say find the value of this if your x is equal to ... let's say it's two. What should you do? You come and substitute, wherever you see an x , you substitute that value that is given. Plus four times two squared minus three times two cubed minus four. Do you all remember this? 08:29
Board
Shot
- 08:28 67. Learners: Yes, sir.
68. Teacher: Alright, now can we try and find and solve this? What is two times two?
69. Learners: Four.
70. Teacher: It's four. So you got a four here. What is two squared?
71. Learners: Four.

72. Teacher: Four. Four times four? It's plus sixteen. It's plus sixteen. Now let us come to this. What is two cubed?
73. Learner: Eight.
74. Learners: Nine. Nine.
75. Teacher: Okay, what does two cubed mean?
76. Learner: It's six.
77. Learners: It's eight sir. It's eight. It's three times three. ... Eight. It's eight.
- 09:00 78. Teacher: So what is two cubed?
79. Learners: Eight.
80. Teacher: Alright, it's eight. Eight times minus three? Eight times three is?
81. Learner: Twenty-four.
82. Learner: Eight times three?
83. Teacher: Okay, eight times minus three therefore is ?
84. Learner: It's minus twenty-four.
85. Teacher: It's minus twenty-four and the last one does not have an x , it's minus four. Let me write it here. I don't have enough space. We are saying you should get four plus sixteen minus twenty-four minus four. What should be the value of this? How do you simplify further? What is four plus sixteen? 09:20 Board Shot
86. Learners: Twenty.
87. Teacher: It's twenty. What is minus four minus twenty-four?
88. Learners: Minus twenty-eight.
89. Teacher: Minus twenty-eight. What is twenty minus twenty-eight?
90. Learners: Minus eight.
91. Teacher: Minus eight. That is your value of the expression. 09:47 Board Shot
92. Learners: Hoe pragtig! {How beautiful}.
93. Teacher: [Inaudible] speaks with a second teacher at the door.
94. Teacher: Alright, the maths competition.
95. Teacher 2: Right. Er. Rhodes High is taking part in a maths competition at UCT this year. So [10:00] what I want to raise from every class, I want some names and Mister Thompson, er Mister Lungi will take the names from those who are interested. And we have practise on a Wednesday after school, okay? Thank you. Let me ... just get me a couple of names. All of you, thanks.
- 10:17 96. Teacher: Are there any people who would like to participate in that competition? You would? One, two, ... three. ... Alright. Now, gentlemen, this is what we have to do to move from that. We'll be adding terms. ... We'll be adding terms. I'd like you take this

- into your books.
97. Learner: Must I write the heading terms, Sir?
- 10:54 98. Teacher: Yes. ... [11:00] Addition and subtraction of terms. First one that we're gonna deal with is addition. ... How can you add terms? We are only allowed terms if they are alike. ... If they are alike. You can only add terms that are alike or the same. ... So before we can add we need to identify terms that are alike. I'm just going to give you some, few terms and would like to ask you to identify. [12:00] ... I've just given a long expression, of a number of terms. I would like us to identify first the terms that are alike. How do you know that terms are alike? We stand to look at the powers when we talk about like and unlike terms. Which one has the same power here? Two a squared is of the same power as? 11:21 Board Shot 12:22 Board Shot
99. Learners: Five a squared.
100. Teacher: Five a squared. Let us put them together. Two a squared, let us put it together with the plus Five a squared. Why do you say they are alike? Because they are having the same power. They are having the same index. The index is two. The same power. So those terms are alike. What about minus three a ? Which term [13:00] is alike to minus three a ? 13:02 Board Shot
- 13:02 101. Learners: A . Minus five a .
102. Teacher: It's minus five a .
103. Learners: And minus a , sir.
104. Teacher: Just hold on. ... And?
105. Learners: Minus a .
106. Teacher: And minus a . The reason why I'm cancelling is so that I don't make confusion of repeating terms or leaving out some terms. Now let us come to the last one.
107. Learners: Plus five.
108. Teacher: What is a like term to plus five?
109. Learners: Plus two.
110. Teacher: It's plus two.
111. Learners: And plus three.
112. Teacher: And plus three. ... Alright. Now let us look at these and verify if really they are like terms. Do these have the same power? 13:31 Board Shot
113. Learners: Yes, sir.
114. Teacher: Yes, the same power is?
115. Learners: Two.

116. Teacher: It's two. Alright? Do these have the same power?
117. Learners: Yes sir.
118. Teacher: Yes. What is the power? 13:47
- Board
- Shot
119. Learners: One.
120. Teacher: It's one. It's a to the power one. So the power is one. So these are like terms.
What about these?
121. Learners: Yes. 13:55
- Board
- Shot
122. Teacher: What is the power of these terms?
123. Learners: Nought.
- 13:58 124. Teacher: It's zero. Because you [14:00] say we can write them as five a to the power of zero. We can write down as two a to the power of zero. That is what we agreed upon, alright? So now we can add them up. What is a minus two and a plus five?
- 14:15 125. Learners: [Inaudible]. 14:15
- Board
- Shot
126. Teacher: Now, now, now, now, now. Let us see, copy this down first. Copy this down. Then I would like each one of you to answers this in your book. What is an answer to these two terms? What is a plus five and a minus two? We did this. What is a minus two and a plus five. I want to see that. What should be the answer to those two terms? Copy it down and then you answer it for me. ... 14:48
- Board
- Shot
127. Learner: Excuse me, sir? [Inaudible].
128. Teacher: I'm gonna show you that. You need to find what this co-efficient is. [15:00] ... One thing I would like to know from you. What is a minus two plus five? 14:59
- Board
- Shot
- 15:15 129. Learner: Three.
130. Learners: Equals a plus three, sir. [Inaudible].
131. Teacher: I'll be walking around and seeing how you're answering this but I need to do an example first with you. ...
132. Learner: [Inaudible].
133. Teacher: Are you finished copying?
- 16:00 134. Learners: Yes, sir.
135. Teacher: Alright, now this is what you do. Because we are speaking of apples, we can only add apples to apples; oranges to oranges. Which means like terms together.

136. Learner: Yes, sir.
137. Teacher: Now, whatever answer you're gonna get here, it should be the answer of apples alone. I've got minus two apples and plus five apples. What should be the answer of minus two plus five?
138. Learners: Plus three.
139. Learners: Three.
140. Teacher: Plus three. Therefore it's plus three apples that's why I'm still having a squared. Alright, now let us come to the next one. What is a minus three, a minus five and a minus one?
141. Learner: A minus nine.
142. Learners: Minus nine.
143. Teacher: Okay. How do we get minus nine? Minus three and minus five is?
144. Learners: Eight.
145. Teacher: No, it's not eight.
146. Learner: Minus eight.
147. Teacher: It's minus eight. Minus three and minus five is minus eight. Minus eight minus one is?
148. Learner: Minus nine.
149. Teacher: It's minus nine. Now we no longer have apples but we've got [17:00] oranges. 17:02
Okay? Now let us come to the last bit. ... Let us come to the last bit. What is five plus Board
two? Shot
- 17:14 150. Learners: Seven.
151. Teacher: Seven plus three.
152. Learners: Ten.
153. Teacher: It's ten. So the answer to this term is three a squared minus nine a plus ten. 17:26
That should be your answer. ... Let me do another one together. ... [Cleans board]. Board
[18:00] ... [Writes] ... Shot
- 18:23 154. Learner: Must we write that down, sir?
155. Teacher: Yes. ... [19:00] ... Alright. We're gonna do this together and then 19:32
there'll be a chance for you to try it on your own. There are two methods that we can Board
use. One is the horizontal method which we've used on top and the second is the vertical Shot
method. The horizontal method is adding all the things horizontally. It's adding them all
horizontally as we have done there. The vertical method is going to [20:00] add them
downwards in rows, okay? The horizontal method adds them in a straight line. The
vertical method is gonna add them in rows, downward. Okay. Now let us do that. We are
saying we got two x plus five and then the second, we've got minus x plus three. You are
required to add these two. What should you do? It's two x , what is the like term to that?

- 20:31 156. Learners: Minus x .
157. Teacher: It's minus x . Alright. And then you got plus five. What is the like term to plus five?
158. Learners: Plus three.
159. Teacher: Plus three. Okay, now let us add these. What is minus, what is two x minus x ?
160. Learners: Three.
161. Learners: Three x .
162. Learners: One x .
163. Teacher: What is two minus one?
164. Learners: One x .
165. Teacher: It's x . It's minus one x . What is five plus three?
166. Learners: Eight.
- 20:59 167. Teacher: It's plus eight. [21:00] Okay. So the horizontal method, it adds terms towards one direction. It moves in that direction, okay? That is the horizontal method. ... Now let us do the vertical method of addition. We are saying we got two x plus five. Now this is how we are gonna group them. Where should the x be? It should be underneath the two. We got there minus x . So like terms are grouped in one row, alright? Where should the plus three be? It should be underneath five and now we can add. What is five plus three?
168. Learners: Eight.
169. Teacher: It's eight. It's plus eight. What is two minus one?
170. Learners: One.
- 21:55 171. Teacher: It's one x . Therefore answer is x plus eight. [22:00] And later on we'll stick to the vertical than that one but I need you to be capable of doing that one as well. ... Now we're gonna try with the second example. You guys have to do it. I would like you to try with the horizontal method and then with the vertical method on that one. Number b. ... Let me stress that one. I would like you to try number b with the horizontal method. Everybody with the horizontal method. I'll be walking around and checking how you're doing. ... [23:00] You've done it nicely.
- 22:00 Board
22:02 Shot
22:02 Board
Shot
- 23:15 172. Teacher & Learners: ... [Inaudible].
- 23:36 173. Teacher: What are you doing? Why to the power two? These are like terms. ... [24:00] ... This is not a like term. These are the only like terms here. Y and x squared, alright? Now can you try the vertical method? This gentleman has got the right answer. ... [Inaudible] Get the answer. [Inaudible].
- 25:00 174. Learner: Will sir come check mine please, sir?
175. Teacher: Yes, I'm coming. Move with the row please. ... So these are like terms here. Where's your what? [Inaudible].
176. Learner: [Inaudible].

177. Teacher: [Inaudible]. ... [26:00] ... He's got both the horizontal and the vertical methods correct. ... [Inaudible]. ... [27:00] ... [Inaudible] ...
- 27:45 178. Intercom announcement: Attention all teachers, when the bell rings again, it will be second period and thereafter it will be break [inaudible] so when the bell rings now, it will be second period and thereafter it will be break.
- 28:00 179. Bell rings.
180. Teacher: Guys, can I quickly go through your books before you go home? ... Before you go to the next period. Right, like terms together.
181. Learners: [Noise.]
182. Teacher: Minus two x . Only like terms. Can you do that whole term?
183. Learners: Yes
- 28:57 184. Teacher: Can you do the vertical method only? Do it here. [29:00] Can you do the vertical method only? Guys, the periods have been shortened because of that long assembly. Correct. Ja {Yes}, that's right. That's correct. Do the vertical method. The method is correct. Before you go, can I have a look at your books? [Inaudible]. Ja {Yes}, I'm just gonna look and see.
185. Learners: Sir, is the vertical method correct?
186. Teacher: That's correct.
187. Learners: Yeah!
188. Learners: Sir!
189. Teacher: I'm coming to you. I'm on my way. [30:00] ... Alright. Vertical?
- 30:06 190. Learner: The bottom one, sir.
191. Learners & Teacher: [Inaudible]. ... [31:00] ... [Still inaudible]. ...
- 31:19 192. Teacher: What is the answer here? Write the terms down. X squared plus four x . What is this and that? [Inaudible] ... minus two. [Inaudible].
- 31:50 193. End of lesson.

[School P2 Lesson 1]

Time	#	Speech	Notes and comments
	1.	Period started @ 10.30 am. Lesson gets under way @ 10.40 am. [the lesson was about Exponents/Indices.]	The lesson commenced at 10:40 am while the period started 10:30
	2.	Teacher: ..the multiplication. Nê. {Right.} Today we going to do the division. Division. [Teacher writes /Division/ on the chalkboard] Any problems about yesterday's one?	Teacher remanded learners on multiplication that was taught before.
			No logic followed here
	3.	Learners: No.	
	4.	Teacher: Any problems about yesterday's one? The multiplication?	She said repeatedly
	5.	Learners: No problem.	
00.20	6.	Teacher: Alright. Today we doing division. If you still remember yesterday, what we did. we said when we are doing multiplication, you add your ...?	???
	7.	Learners: Exponents.	
	8.	Teacher: <u>Ja</u> {Yes}. Then in division now we subtract... →[exponents/indices] [Teacher wrote "subtract the exponents' on the chalkboard] the opposite multiplication we → [add]	eg : $a^2 / a^1 = a^{2-1} = a^1$ → answer
	9.	Learners: add	
	10.	Teacher: and division you	She wanted learners to complete the sentence.
	11.	Learner: subtract	
01.00	12.	Teacher: Ok! Say for instance we having seven to the power three, divide by seven to the power one, [$7^3 \div 7^1$] or seven [erasing the power one on the chalkboard]. Yesterday what I told you is that if the number does not have an index or an exponent you must know its always	$7^3 \div 7^1 = \text{-----?}$
	13.	Learner: One	
	14.	Teacher: Nê? {Right?}.	
	15.	Learners: Yes	
01.36	16.	Teacher: So lets say take seven to the power of two ...[7^2] this is division. seven cubed, [7^3] seven to the power three divide by seven to the power two.[$7^3 \div 7^2$] [Teacher indicates to a learner that because they are busy with class work, the desk must be positioned so that he faces the front of the classroom.] So you know, you subtract your ...?	The teacher was looking at the board while saying this
	17.	Learners: exponents	They responded
	18.	Teacher: <u>andithi</u> ? [right?]	

19. Learners: Yes.
20. Teacher: So here, how many sevens do we have? She pointed on the board
21. Learners: Two ... three.
22. Teacher: It's seven, seven, seven .. then you divide by how many sevens? $\frac{7 \cdot 7 \cdot 7}{7 \cdot 7}$ the teacher cancelled up
She was left with 7
23. Learners: Two
24. Teacher: Seven, seven. The long method is a primary method [referring to primary school] but we are not using in high school.
25. Teacher: Then what you do, you cancel seven and seven. Nê? {Right?}
26. Learners: Yes.
27. Teacher: Then seven no [and] seven. Then lo ushiyekileyo uzakuba yintoni? [What happens to the seven that is left?]. Yi-answer [It's an answer]. So the one that you do not cancel is your ...?
- 02.33 28. Learner: Answer.
29. Teacher: So how many seven ezishiyekileyo? [How many are left ?]
30. Learners: One [1]
31. Teacher: Then the answer is?
32. Learners: Seven [7] 7 was an answer
33. Teacher: Power ...?
34. Learners: One
35. Teacher: Because, if you subtract three from two, ufumana bani? [what do you get?] Era committed → not subtract 3 from 2 but subtract 2 from 3
3 - 2 =
....?
36. Learners: One
37. Teachers: So uyabona yinto enye le yana? [can you see that it's the same thing?]. Seven to the power ...? 7^{????}
38. Learners: One
39. Teacher: Uyabona? [Can you see?]
40. Learners: Yes

- 02.53 41. Teacher: So it is like seven ... You take seven as your common what ...? Niyakwazi? [Do you know?] Seven is your common...? Yesterday we said we have two sevens, so seven is your common ...
42. Learners: Base
- 03.07 43. Teacher: Seven is your common base and then uthi [you say] three, you subtract your exponents three minus two ngolo hlobo [this way]
Niyakwazi? [do you know]
44. Learners: Yes
45. Teacher: Then kushiyeke bani [what is it that is left? Or what is left?] Seven then three minus two is ...?
46. Learners: One [1]
47. Teacher: So iyafana [it's the same] ngu-seven [it's seven] to the power one. [7¹] So iyafana noba uyenza ngolohlobo [so it's the same even if you do it this way]. You can do it like this [teacher pointing at $\frac{7 \cdot 7 \cdot 7}{7 \cdot 7} = 7$] or you can do this 7^{3-2}
- [Teacher pointing at both methods . [Which method is the easiest between the two?]
- Method 1
method 2
- $$\frac{7 \cdot 7 \cdot 7}{7 \cdot 7} = 7^1 \quad \text{or} \quad 7^{3-2}$$
- 7.7
- 03.45 48. Learners: Both?
49. Teacher: Alright. Number two. If the number that has not been cancelled in below kwi-denominator [as the denominator]. What do we do with it? Lets say eight to the power five divide by eight to the power seven. [8⁵ ÷ 8⁷]
- Ngubani ofuna ukutraya? [Who wants to try?] Eight to the power five divide by eight to the power seven. [8⁵ ÷ 8⁷]
Uyafuna? [Do you want to try?]. [Teacher indicates for a learner to take the chalk from her and do the problem on the chalkboard] ...
- {one boy stood up to follow teacher's instruction and wrote}
- $$\frac{8^5 + 8^7}{8.8.8}$$
- [This has been 'copied' from the previous example.]
- The teacher intervened by saying No, and indicates the statement on the board by pointing that it was incorrect]
[Thethani! {Speak!}. How many eights? [8s]
- Teacher wrote: 8⁵ ÷ 8⁷ on the board
- The teacher said: '**Take the chalk Men because Boys might lead you**' the teacher was referring to the culture where they always say **Men** must lead **Boys** . She was trying to awaken those who are called **Men among Boys** in class.
- {The video was checked}
- She said
- 05.09 50. Learners: Five. [Boy continued on the board.]
- The boy added three eights: 8.8.8 and start cancelling two 8s:
- 8.8.8.8.8

51. Teacher: U-cancelisha nabani [What are you cancelling? Or with what are you cancelling those 8s?] When you are cancelling, you must cancel your denominator with your numerator. There is no way you can cancel one number. Uli-cancelisha nabani eli inani? [With what number are you cancelling this one?]. Hayi [No]
- 05.26 Makaze oyibonayo. [Who ever understands must come to the front!] Ngubani ofuna ukumnceda? [Who wants to help him?]
- U-righthi? [Is he right?] U-righthi apha kwesi i-step? [Is he correct on this step?] Can we get one of you to help us?
- 06.55 One girl learner responded and wrote:
- $$8^5 \div 8^7$$
- $$= \frac{2}{8}$$
- $$= 8^{-2}$$
- Is the girl right? [teacher asked the class]
- Is she right in this step? [teacher pointed on the board]
52. Learners: No
- 07.33 53. Teacher: What is it that is wrong? What is it that is not right from this step? What is wrong from there? [Pointing to the board].
54. Learner: Sorry Miss. This statement [pointing at $\frac{2}{8}$] must not be here, it must be here [pointing to the position after $\frac{2}{8}$]
55. Teacher: Do we have something left from kwi-numerator [from the numerator?] If you look carefully from here, she is right from this side, but from that side she is wrong because there is nothing left from the numerator everything has been cancelled, andithi? [right?]
- Teacher also wrote: $\frac{8}{8} = 1$
- and
- $$1 \times 1 \times 1 \times 1 = 1$$
- What is left in the numerator is one [1]
- The boy could not remember correct.
- The teacher call for the next learner to help.
- He wrote: 8.8.8.8.8
- 8.8.8.8.8.8 and start cancelling up all top 8s . two 8s were left on the denominator.
- $$\leftarrow \frac{2}{8}$$
- $$\leftrightarrow 8^{-2}$$
- One boy learner said : $\frac{2}{8}$ must go down
- Teacher wrote:
- $$8^5 \div 8^7 \rightarrow$$
- $$= \frac{2}{8}$$
- $$\uparrow = 8^{-2} \text{ right}$$
- She is wrong here** [she pointed] because everything in the numerator has been cancelled only one [1] left.

56. Teacher: How many 8s left in the denominator?
57. Learners: two [2]
- 08.35 Teacher: so she has: $\frac{1}{8^2}$ do you notice this? or can you see? $\frac{1}{8^2}$ written to positive index
58. Learners: Yes
59. Teacher: What is left is one. So what is left from the numerator is one. It is not two, and how many eights kwi-denominator shiyekileyo? [from the denominator that is left?]. So therefore uno-one [you have one (1)] over eight to the power of two. [$\frac{1}{8^2}$]
- 8^2 Uyabona? [Can you see?]. Then ke ngoku yena uyitshintshile wayenza ngenye indlela exponentially, [then, she had changed it to another exponential form]. Do you understand?, that's why she has eight to the power minus two, [8^{-2}] xana injena i-positive[if it is like this, then it is positive], positive exponent and then watshintsha [changed it to] a negative exponent. So le point uyiphosile [you have missed this point] niya-understanda bethunana? [Do you understand people?]
60. Learners: Yes
- 09.00 61. Teacher: So if there is nothing left from i-numerator [the numerator] just write one and then i-denominator [denominator] you count how many numbers that are left, Ok?!]
- $\frac{1}{\text{denominator}}$
62. Learners: Yes
63. Teacher: Uyabona ke? [Can you see?]
64. Learners: Yes
65. Teacher: And then to change it to positive exponent. To change it into a negative exponent, you write eight to the power minus.. 8^{-2} ?
- 8^{-2}
66. Learners: Two
67. Teacher: Alright?..ubani ofuna uyayibhala [who else wants to write?] Teacher opened the text book.
68. Learners: [no response]
- 09.30 69. Teacher: Okay, open your textbook. Activity number four. [4]. Simplify five to the power six divide [5^6] --[the text could not be picked up clearly] Activity 4 page 28, simplify, it is the last one from that .. Simplify 5 to the power 4 divide by 5 to the power 4 [$5^4 \div 5^4$] [Teacher wrote $5^4 + 5^4$ on the chalkboard.] Activity number 4, exercise 5 .. 5 into 5 divide by 5 into 5 ...
- Simplify
 $\leftarrow 5^4 \div 5^4$
 Activity 4 exercise 5
 5 into 5 \div 5 into 5
- 10.37 [Learner goes to the board to do $5^4 + 5^4$] [The teacher now out. The teacher calls

realises that this is a solved problem in the textbook.] I did not know that, sorry, sorry, sorry 2 into 7 divide by 2 into 2, 2 into 2

But what was written on the board is:

$$5^4 \div 5^4$$

[Writes $2^7 + 2^2$ on the board] ... 2 into 7 divide by 2 into 2 ...

[Learner at the board writes $\frac{22222222}{2222222}$, before the teacher intervenes.]

Error committed: 2 into 7 = 2(7)

Not

$$2^7 \div 2^2$$

←

$$5^2 \quad \text{[learner's answer]}$$

11.33

2 into 7 divide by 2 into 2. [Learner erases 4 two's from the denominator.] [Learner 'cancels' 2 two's from numerator with 2 two's from the denominator, and then writes 5^2 as the answer.]

12.48 70. Teacher: Is she right? Is she right?

71. Learners: Yes, down here.

They pointed

72. Teacher: Hai, hai, hai

She wrote: $2^7 \div 2^2$

73.

Learners: [one girl wrote: $2^7 \div 2^2$

$\frac{2.2.2.2.2.2.2.2.}{2.2}$ she started cancelling
two 2s from numerator and one 2
from the denominator

$$\leftarrow 5^2 \quad \text{[learner's answer]}$$

74. Teacher: Five into two, five into two, how many fives? How many fives? I-answer yakhe [her answer] is five into two. [5^2] How many fives? [5s]

75. Learners: Two

76. Teacher: How many fives? How many fives?[Teacher raises her voice.] [Says to the class] I am not asking her [referring to the learner who had worked on the board] Bangaphi aba-five ababhale pha? [How many fives did she write on the board?]

??----- [the teacher was asking the class while she was holding the girl on her shoulder.]

77. Learners: Two

78. Teacher: Ok! Lets multiply, five times five is. [$5 \times 5 = \text{----?}$] Five times five is ..? [$5 \times 5 = \text{---?}$]

79. Learner: Twenty-five [25]

80. Teacher: Is she right? → Spayile!, do you understand Spayile?

She called the name of one boy in class

81. Learner: [the learner looked confused]

13.47 82. Teacher: What is wrong? Jonga i-mistake yakho pha [look at your mistake there]. What is wrong from the answer? .. What is wrong there? ... What is wrong? What is wrong from the answer? Do you understand? Do you understand what is

The teacher was gaining emotions

94. Teacher: And then, is six [6] a factor of twenty four [24]? So u-six uya kangaphi ku twenty-four? [Six [6] goes how many times into twenty-four [24]?] $\frac{24}{6}$
95. Learners: Four [4] 4
- 18.12 96. Teacher: Four times [4], uyayibona lo nto? [can you see that?]. We don't have a common base whereby kwi-numerator [from the numerator] we've got two nakwi-denominator [from the denominator], we've different factors now, right? $\frac{24 \cdot y \cdot y \cdot y \cdot y \cdot y \cdot y \cdot y \cdot y \cdot y}{6y}$
97. Learners: Yes
98. Teacher: We don't have a common base, 6 is a factor of 24 and you are left with 4.yyyyyyyyy $4y^9$
99. Learners: Easy
100. Teacher: So, six [6] to the factor of twenty-four [24], and six goes into twenty- four $[24/6]$. Four times [4], and then you cancel this one and you cancel this one. Nê {Right} now we are left with four [4] and how many y's?
101. Learners: Nine. [9] Then its four [4] y to the power of nine[9] then its your answer. $4y^9$
- 18.40 102. Learner: Its easy
103. Teacher: Is it easy?
104. Learner: Yes
- 18.45 105. Teacher: Ok if its easy, nantsi ke elandelayo [here is the next one], then will give you homework after this. It's four x [4x] to the power of three [3] y divide by two x [2x] to the power of two [2]. $\frac{4x^3y}{2x^2}$
- Now simplify. [Teacher writes $\frac{4x^3y}{2x^2}$ on the chalkboard] Calu-calula intsho into. [Simplify, as said] Baphi abanye abantu? [Where are the other learners?] Do you want to come and try?
- {Umntu makaze azo bhuda ebhodini bethuna.}
- [Come and make mistakes on the board people].
- Andifuni kuze abantu abanye kaloku [I don't want the same people all the time]
- {Simplify.}
- 20.00 106. [Learner does the problem on the board] {Speaking to the class} She divided 4 by 2 to get 2
107. Teacher: Do you understand?
108. Learner: Yes

21.09 **109.** Teacher: Are we fine? {Thetha nabo} {Speak to the class}
 {Suka ebhodini, kaloku uyatitsha, kukho abangayi understandiyo}
 {Uyabona izakuba ngathi abayilandeli iMaths abantwana bale klasi kuba kusoloko kuphakama abantu abanye isakugqiba iklasi igcwele kangaka. Izakuba ngathi bayi 4 abantu abalandela iMaths kule lkasi}

{It looks like there are only four learners who understand Maths in this class and yet the class is full. It is because only the same people show an interest of standing up}

110. Learner: Yes.

22.36 **111.** Teacher: Because of the time, homework. I did sign some of your books yesterday. Others must bring their books to sign. [Teacher writes homework on the board for the learners.]

Homework: Simplify the following exponents:

(1) $\frac{12m^7b^6}{3m^2b^4}$ (2) $\frac{6^4}{6^8}$
 (3) $\frac{3^9}{3^4}$

Homework:

Simplify the following exponents:

(1) $\frac{12m^7b^6}{3m^2b^4}$
 (2) $\frac{6^4}{6^8}$
 (3) $\frac{3^9}{3^4}$

25.40 Is there any one with the exercise book on his/her possession?

Learner: Yes

26.20 **112.** [Learners work on these problems to end of the period.]

Teacher: [was heard saying: ‘ You don’t understand but you are good in gossiping and charting]

How many 2s?

113. Learner: 14

114. Teacher: there are 14 we say 2.2.2.2 by 14 times.

The homework must be written at the back of you book in order to leave the space for the corrections.

The video ended up when the teacher was busy checking learner’s work, doing individual attention

30.09 End of lesson

[School P2 Lesson 2]

Time	#	Speech	Notes and comments
	1	[Period started at 10:30, but the teacher arrived 5 minutes late, and the lesson only started at 10:37.]	
00.00	2	[Learners doing a problem on the board that was for homework.]About 4 minutes of speech and activity have been omitted during transcription.	
00.38	3	Teacher: Hayi, sukuyenza wedwa, beka incwadi le.....{inaudible} {No, don't do it alone, put the book here} Yintoni iproblem yenu? {What is your problem?} {Learners are mumbling.....inaudible}	Boy wrote: 1) $\frac{12m^7 b^6}{3m^2b^4}$ <u>12mmmmmmm. bbbbbb</u> 3mm bbbb = $4m^5b^2$ Some words were not picked up properly by the video.
		<u>U-b to the power two uzoba phezu?</u> {Is (b^2) to the power two going to be on top?}. <u>Ayi-ngo over?</u> {Is it not over?}. So b stays that way? How many bs? Did he cancel all bs in the denominator?	
	4	Learners: Yes	
04.07	5	Teacher: Oh! ok. Number two...awubhali nto ngoku{you don't write anything now}. You don't write anything. It was a homework, close your books, it was a homework, you don't write anything now, you suppose to do it at home. Hlabeni do you understand? Payile do you understand? Go to the board and write it. Any problems from that one? {pointing to the board}	Learners said 'yes'
04.48	6	Learner: No problems. [One learner says /problemo/]	
	7	Teacher: [Hlabeni] do you understand? The next one is yours. [Payile] do you understand? Go to the board and write the next one.. If you do understand.	
05.01	8	Teacher: Number two, ..six... six to the power of four divide by six to the power of eight,($6^4 \div 6^8$)iphelele apha? {is this complete?} [Teacher wrote $6^4 + 6^8$ on the board.]	Teacher wrote $6^4 \div 6^8$ on the board
	9	Teacher: Ok ?..	
	10	Learners: Yes	
05.57	11	[Teacher hands over the chalk to a learner to do the problem on the board. The learner asks a peer for assistance. Whilst the learner writes $6.6.6$, the teacher says /second step, second step/, /write it below that/. Problem written down as $\frac{6.6.6}{6.6.6.6.6.6}$]	Teacher was interacting while the learner was writing, saying second step.
	12	Teacher: Uh, uh!	Learner kept on asking others for assistance

- 07.07 **13** Learner: Cancelisha u-six babebayi-four {cancel four six}. [The with four factors of 6, in the denominator.] Xa uqgibile ubhale pha ezantsi u-six {when you are finish, write 6 at the bottom, to the power of four (6^4)}
- Other learner told him to cancel four six (6666).
 learner at the chalkboard 'cancels' four factors of 6, in the numerator,
 learner wrote: 6^{-4}
- 07.54 **14** Teacher: U-right? {Is he right?}
- 15** Learner: Yes
- 08.10 **16** Teacher: Change it into a positive, change the exponent to a positive. Go and write it. [instructing a learner][Learner wrote $\frac{1}{6}$] ... [laughed by some learners]
- Worked sum was shown as:
 $6^4 \div 6^8$
 $= \frac{6.6.6.6}{6.6.6.6.6.6.6.6}$
 $= 6^{-4}$
 $= \frac{1}{6}$
- 17** Teacher: Yesterday I told you that xa injena {when it is like this} .Kwi-negative form andithi? {in a negative form right?}
- 18** Learners: Yes
- 19** Teacher: Then when you change it into a positive form you must write it one over six to the power of four. $\frac{1}{6^4}$] How many six left?
- The teacher writes $\frac{1}{6^4}$ on the board
- 20** Learners: Four, four
- 21** Teacher: How many six left?
- 22** Learners: Four.
- 08.54 **23** Teacher: One, two, three, four andithu? {right?} Six that are left .zintoni? {what are they?} Zi-under i-denominator {they are below the denominator}. That's why i-exponent ine-negative sign.nhe? {the exponent has a negative sign, right?}, but kwi-numerator {from the numerator} we only have one, we cancel everything kwi-numerator {from the numerator}, so we are left with bani? {what?} One, and then i-denominator yethu sinabani? {what do we have as our denominator?} How many six left?
- 24** Learners & teacher: Four
- 25** Teacher: Nê.
- 09.24 **26** Teacher: That is why i-answer yethu ingu-six into negative four {That's why our answer is six into negative four} and then we change it into positive. Then xa uyenza
- Grammar mistake
 Teacher said: six into negative four. as if $6(-4)$

positive izakuba ngu-one over six to the power four
 {Then it is going to be one over six to the power four
 $(\frac{1}{6^4})$. .Kufuneka ukwazi uyitshintsha i-negative

{You must be able to change negative} to positive and positive to a negative. Ok! Now we are doing number three.

27. [Teacher writes problem number 3 on the chalkboard]
28. Teacher: Number three is three to the power of nine divide by three to the power four ($3^9 + 3^4$), qha?!{only?!} [Written on the board.]
- 10.17 29. Learners: Yes
30. Teacher: A girl ..This time. We did this in grad 8. [] Gladys! Haibo! Nayizolo bekuphakamise izandla ezinye apha.{No, even yesterday were the same hands up}[] Ladies iza! {come} [Learner goes to the chalkboard to do the problem.]More Xhosa speech missing. Teacher calls the Girl , Gladys
31. Learner: O three baaphi? {How many threes (3) ?} Learner asked the class
32. Learners: Nine.
- 11.33 33. [The learner at the chalkboard proceeded writing $\frac{3333333333}{3333} = 3^5$ The problem is actually not done by the learner at the chalkboard.
- She continues to recruit answers to the questions that she posed, as she proceeds from one step to the next.]
- 12.06 34. Teacher: What is the answer? ..Who did not do the homework? Be honest. Who didn't do the homework? Who didn't finish the homework? Ok, first, who didn't do the homework? Why? [pointing to a learner] Khumsha ke ngoku {Speak English now}. Why didn't do your homework? Shoo!.....Shoo! [telling the learners to be quiet]
35. Are you an athlete, that is not an excuse you will rather do it and leave unfinished.]
- 13.13 36. Teacher: That's not an excuse not to do your homework people. Rather do it and leave it unfinished. I don't take i-excuse mna {an excuse} of not doing i-homework {homework}If you are stuck, leave it, but attempt the homework. Attempt the homework people please, its not an excuse of not doing homework, you need to practice maths bethunana {people}. You won't understand maths if you don't attempt it by practising it, ok?!
37. Learners: Yes
- 13.20 38. Teacher: Ngubani omnye?{Who else?!} Who didn't finish homework? Why? Teacher was looking to the learners trying to identify those who didn't do the work.
39. Learner: [Learner explaining his/her reason - speech is not audible.]

- 14.20 40. Teacher: You don't understand this division part, but you didn't tell me yesterday that you don't understand and I told you last time that if you didn't understand it, after school make an appointment with me, don't rush to go to home, if you don't understand. It's a major, its compulsory that you have to pass, you'll do maths up until grade twelve and once you lack i-basics {the basics} ze-maths {of maths} you will be having an attitude. Don't rush to go to home if you don't understand make an arrangement, I'm willing to stay behind and assist you people, its not and excuse uzangayenzi i-maths {not to do maths} You did maths e-primary {at primary} and you did it last year kwa-grade eight {from grade eight}. Isezi-basics ezi {these are the basics} not even grade nine work. We was just doing the basics so far. Wena?! {And you?!} [Pointing to the learner].
41. Learner: [Learner explaining but cannot make sense of what he is saying - speech inaudible - too much background noise.] speech inaudible - too much background noise.
- 14.37 42. Teacher: Azukuphinda yenzeke lo nto leyo, ok?! {That will never happen again, ok?!}
43. Learner: Yes
44. Teacher: If you didn't follow me, don't let me go without informing me that xolo miss {sorry teacher} I didn't understand this one. Come and make an appointment with you, ok?!
45. Learners: Yes miss
- 14.50 46. Teacher: Wonke umntu kufuneka azame ukupasa apha eklasini {Everyone in this class should try to pass} Its compalsary, you will do maths up until grade 12.
47. Learner: Yes
48. Teacher: Because now I cannot move to from scratch another step if kukho abantu abangakhange bandi-understande {if there are people who did not understand me},ok?!
49. Learners: Yes
- 15.10 50. Teacher: Open your textbook Activity number six (6), page thirty (30), page thirty, activity number six. We did i-multiplication mos? {right?!} First we started with multiplication,nhe? {right?}and yesterday we did division, ok! And what I told you that any .base . with a zero .. exponent, you know the answer is always ...? [A lot of idle chit chat]
51. Learner: One [Teacher trying to find a page]
- 16.31 52. Teacher: Alright, ok! For those ones who didn't follow us, sizokufuna umntu ozivayo {anyone who feels that she/he can do the sum on the board} go and do number H, nine (9) into six (6) divide ÷ by nine (9) into zero brackets times...simplify each problems give all the answers with positive exponents try to use the division rule rather than {teacher read from the text book}.
The sum was simplify

writing each problem out in full [] ... Now we are? If we are having five to the power two divide by five to the power four, $5^2 \div 5^4$. This one now I don't want to use this

method, ok?! [points to $\frac{6.6.6.6}{6.6.6.6.6.6.6.6}$]

53. Learners: Yes
- 17.30 54. Teacher: We need to shorten it now, sikwa-grade nine mos ngoku{we are in grade nine now} so the short method esiza kuyisebenzisa{that we are going to use}. This is five to the power two, ii-base{the base} are the same andithi?{right?}
55. Learners: Yes
56. Teacher: Yesterday we said, if we are doing i-division{division} you subtract the ...?
57. Learners: Base Incorrect response from learners
58. Teacher: The what?
59. Learners: The base
60. Teacher: You subtract what?
61. Learner: The base
- 18.00 62. Teacher: You subtract your [waves her hand in the air indicating the exponents]
63. Teacher: Alright. So it's five, you take five as your common base and then you just subtract your exponent. Uyayibona? {Can you see that?}
64. Learners: Yes
- 18.14 65. Teacher: I don't want us to use this method anymore. [tapping on the board and indicating the method $\frac{6.6.6.6}{6.6.6.6.6.6.6.6}$] Isityela ixesha lena i-method{This method is wasting our time}. So five is a base and five is a base so therefore five is your common base and then you subtract your ...?
66. Learners: Exponent
67. Teacher: Then izakuba ngubani i-answer?{what would the answer be?}
68. Learner: Five to the power four (), negative four 5^4
69. Teacher: This is two {pointing to the board} five into two minus..Five to the.. Four. $5^2 \div 5^4$
- $$= 5^{2-4} \quad \text{this is 5 into 2 minus 4}$$
- $$= 5^{-2}$$
- $$= \frac{1}{5^2} \rightarrow \text{answer}$$

You apply your sign rule: 2 minus 4, It is two minus four, this is two minus four, i-sign rules ke ngoku {sign rules now}, must apply your sign rules.

70. Teacher: Two minus four, apply your sign rules .Two minus four? {pointing to a learner}
71. Learner: Five to the power negative two (5^{-2})
- 18.40 72. Teacher: Five to the power negative two [teacher writing the answer on the board]. Two is positive, two is positive minus four, addition sign? Addition sign you know the signs, nani nitsho niyazazi i-signs {you said yourselves that you know the signs} So these exponents ikweyiphi i-format? {are in which format?} It's a negative exponent and when you are changing it into a positive ... itsho mos i-question {the question says so right?}, give all the answers with positive exponents, siyayibona? {can we see that?}
- 20.02 73. Learners: Yes
74. Teacher: So if your answer is like this five to the negative two, it means you didn't follow the question, your answer must be in a positive exponent, then we are changing it into a positive exponent izakuba ngubani? {What will the answer be?}... ... If we are changing the negative exponent into a positive exponent, what is it now?
75. Learner: One over five... ($= \frac{1}{5^2}$)
76. Teacher: One over..
77. Learner: Five to the power two. 5^2
- 21.05 78. Teacher: Nantso ke! {There you go!} So izakuba njevana{it is going to be like this}Activity number six (6) ke ngoku{now}. Seven (7)...number E, seven into three divide by seven into zero ($7^3 + 7^0$). Seven...thathi itshoko{take the chalk}. {Learners laugh}
79. [Learner going to the board to do the problem. Writes $7^3 + 7^0$ on the board.]
80. Teacher: Base. Take seven as your common base... { Teacher's speech needs to be captured as she hands the chalk to the learner } [Learners laugh loudly.] Thetha nabo!{Speak to them!}
- 21.49 81. Learner: Seven to the power three minus one [Learner writes:
 $= 7^{3-1}$
 $= 7^2$
 $= 7^3 + 7^0$
 $= 7^{3-1}$
 $= 7^2$
- Learner's chalkboard work
 $= 7^3 + 7^0$
 $= 7^{3-1}$
 $= 7^2$

[Asking the learners in class]

-], so i-answer yakho ngu? {so your answer will be...?} Seven to the power two. I-right? {Is it correct?}
- 22.00 **82.** Teacher: Is this right? (mumbling from class)
- 83.** Learner: Yeseemm....
- 84.** Teacher: What is the law any number with a zero exponent? What is your answer?
{Hayi ke mna andibafuni abantu abagezayo}
{I don't like naughty children}
- 85.** Learner: [Three learners, in succession, say /one/]
- 86.** Teacher: Sithini istatement? [What does the statement say?]
- 87.** Learners: one
- 88.** Teacher: So is she right?
- 89.** Learners: Yes
- 90.** Teacher: [The teacher instructs the learner to ask Mr Roger if the answer is correct. The learner does so. Mr Roger says /no/. Learners giggle]
- 91.** Teacher: Seven into three, nhe?(7^3) {right?} Divide by seven into zero (7^0), ngubani?
{What is the answer?}
- 92.** Teacher: So si-divida ngabani? {What are we dividing by?} Any number with a zero exponent? [Teacher raises her voice] What is the answer? What is the answer for this? [pointing at 7^4]
- One boy went to the board to write: 7^{-3}
= 1 he could not get on with the sum..
- 93.** Learner: One
- 94.** Teacher: Who knows the answer?
- 95.** Teacher: If seven to the power zero is one ..seven into three, ne {right} , divide by seven into zero one, iyafana nalena {it is the same as this one}
- The teacher was pointing on the board
- 23.42 **96.** Learners: One, one
- 97.** Teacher: [writes $7^0 + 1$ on the board] Any number with a zero is always.. ?
- 98.** Learners: One
- 99.** [Learner going to the board to fix the problem that was done wrong by the previous learner. Changes $= 7^2$
 $= 7^0$
to $= 1$. The learner gets stuck and looks for direction
 $= 1$
in other examples on the board.]
- 100.** Teacher: Ngubani omnye une-answer? {Anyone else who has an

answer?} Who knows the answer?

101.

25.45 102. Teacher: Five divide by one?

103.

Teacher: Seven into three divide by seven into zero [writes $\frac{7}{7}$ on the board]

26.08 104. Teacher: Any number with a zero exponent is always..?

105. Learners: One

106. Teacher: Seven into three divide by therefore by ..

107.

Learners: One [Teacher then writes $\frac{7}{1}$ on the board.]

108. Teacher: This [pointing at the 1] the base ... this 1 is a number not a base.... [The learner at the board now attempts to use $\frac{7}{1}$ to simplify $\frac{7}{7}$, but come unstuck. He then asks Mr Roger to help and indicate whether he is correct - the learner had written 7^0 as the answer.]
{Wonke umntu maka mamele kuMr Roger}
{Everybody must listen to Mr Roger please}

MR Roger had to intervene and gave direction to the learner on the board and the video ended when the correct answer was not yet found.

30.13 [There is a consequent discussion between Mr Roger and the learner, in which Mr Roger attempts to illicit appropriate responses from the learner to solve the problem.]

End of lesson

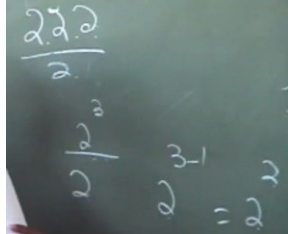
[School P2 Lesson 3]

Time # Speech

Notes and comments

1. Teacher: Written in power notation and then written using the same base. Uyabona? {You see?} wenzelwe ilong method therefore kuthiwa yenze ibe short method and then uphinde uyibonise in an equation with the same base. So phayana ngo two abathathu on top then uba-divide ngo two. So xa uyiyenza wena uzoyiyenza ibe ngutwo to the power of 3 divided by two niyabona? {They have given you the long method and they say that you should make it a short method then show it in an equation with the same base. So there's three two's on top then you divide them by two. So when you do the sum you will make it two to the power 3 divided by two, you see?}

Start of period: 08h05 ; Teacher arrived at 08h02 ; Lesson started at 08h24


2. Learner: Yes miss. [01:00]
3. Teacher: Because kwenzeka lanto to the power of 3 divided by two and then yidivision lena, niyayazi idivision? {Because this happens to the power of 3 divided by two and this is division, you do know division?} kuthi {that} when the base are the same you cancel the exponent nhe? {right?} and then yangu two {it became two}, two is the common base and then yangu 3 {it became 3} ipower apa ngubani? {what is the power here?}
4. Learners: Ngu one {It is one}
5. Teacher: Akabhalwa ke but kuthiwa minus one ukuthiwa ifumana ngutwo to the power of two ke, niyabona? {You do not write it but they say minus one. they say the answer is two to the power of two, you see?}
- 08:25 6. Learners: Yes madam
- 08:26 7. Teacher: Lamzekelo? {That example?} and then ke the rest izokwenziwa nini. {and then the rest will be done by you.} and then B, number B ebhodini. {on the board}, number B, two two two two two bangaphi na o two ? {how many twos are there?}
8. Learner: Bayi three {there are three}
9. Teacher: Divide by two two. Izobangubani? {What is it going to be?} Hayini ke akukhomntu uzokuhlala phantsi ke bethuna, khanindincedeni ngoku. {No one has to sit down people, help me now!} ... [02:00] [metal doors banging continuously]
10. Teacher: Awuzukuyi yenza wedwa, bayayazi bathatha irisk, akekho umntu ongayaziyo lento lena. {You are not going to do this by yourself, they all know this they are just taking a risk. There is no one who does not

know this thing.} What is the next step? Finish that.
Uwubonisiwe mos umzekelo yonke lento mos
 yenzeka ngolahlobo wenziwe ngayo lamzekelo.
 {You have been show the example of the whole sum
 and is done according to the example.}

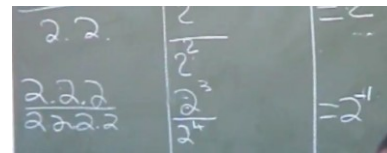
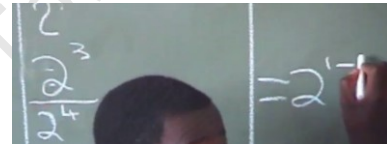
Hayi wonke umntu uyathethe ngoku apha eklasini
 akukho mntu ungathethiyo. Ithini I next step? {Oh
 so now every one in class has something to say,
 what is the next step?} Everybody, ha- ah
 everybody, wonke umntu makathethe, {you must all
 say this together.} thoba isandla. {put down your
 hand.} wonke umntu makathethe, uyawubona
 umzekelo wenziwe njani pha? so ke yonke lanto
 yenzeka ngolahlobo ndiyiyenze ngalo. {Everyone
 must talk, you see how I did that example? So then
 everything happens the way I did it.}

11. Learners: Two to the power three divided by two to the power two.
12. Teacher: Nithe ngubani? {What did you say is the answer?}
[03:00]
13. Learners: Two to the power three divided by two to the power two.
14. Teacher: Divide by two to the power .. two.
Learners: Two
Teacher: Two into two
15. Learners: Ngu two i-answer. {The answer is two.}
16. Teacher: Njani? {How so?}
17. Learners: Two to the power one
18. Teacher: Hmmm?
19. Learners: Two to the power of one divided by two
20. Teacher: Take two as the common base and then subtract the index ... your exponents
21. Learners: Two to the power of two
22. Teacher: Uright. {is she right?}
23. Learners: Yes, miss
24. Teacher: Two to the ...?
25. Learners: Power one
- 08:30 26. Teacher: Hlala phantsi ubeke itshoko. {Sit down and put the chalk down} [The teacher instructs the learner who had been working on the chalkboard to put down the chalk and take a seat.] Beka phantsi le tshoko. {Put down the chalk.} Number C, akukho sandla wonke umntu uyathetha. {No hands, every one must talk.} You may put itshoko {chalk}. two to the power, number C [04:00]

$$\frac{2^3}{2^2} = 2$$

$$\frac{2^3}{2^2} = 2^1$$

27. Learner: What's the question?
28. Teacher: [Mumbled speech by the teacher to the person doing the video recording about learners arriving late during the first period of the day.] The first period is like this. [Metal door bangs again and again.]
29. [Learner writes the problem on the board. **222**.
2222
This task is not completed with great efficiency.]
30. Learners: Two to the power three divided by two to the power four. [05:00] [Various learners were prompting the learner at the board, and repeated parts of the sentence]. Divide by ... two to the power four. Divide .. two to the power two divided by two to the power four.
31. Teacher: Two into four. Okay, then?
32. Teacher: Two is the common base.
33. Learners: Two .. Two to the power of negative one .. two to the power one [Many learners shouting together. Some overlap of speech.]
34. Teacher: Listen carefully to the learners tishala {teacher} [Answers are continually recruited from peers.]
- 08:32 35. Learners: Two to the power of negative one. [Learner at the board writes **2¹** .. other learners laugh. Continuous shouting by learners about what should be done - but the speech is not audible.] Hayi faka u-minus phambi ko one {no, put minus before one} [The learner at the board eventually writes **2⁻¹**.]
36. Teacher: Good boy. Number C .. [06:00]
Shhh .. Number D. This is the last activity ke bethuna {people} from combination of multiplication and division niyayibona lonto? {do you see that?}
37. Learners: Yes
38. Teacher: This one is the last one we will be doing it now, so umntu makamamele carefully especially uzibala ebe-lost {so every one must pay attention especially the one that was lost}. Ebengakhange a-understande at all. {He did not understand at all}. Hayi sukovika ukubamba itshoko {Don't be afraid of holding the chalk}, ingathi udlala ngayo {looks like you are playing with it}. Mayibonakale into oyibhala ebhodini {We must be able to see what you are writing on the board}, yintoni le uyibhalayo? {what are you writing?}. [Learner writes **33333**
33 on the chalkboard.]



39. Teacher: Ithini le. {Explain this one.} [07:00]
- 08:34 40. Learners: Three to the power of five divided by three to the power of two Three to the power of three ..Three to the power of three [The learner at the board clearly does not know what to do. Learners dictate the answer to him, shouting together. He openly looks to his peers for the solution, and copies what they shout. Learners applaud the correct answer.]
41. Teacher: Number E .. number E .. number E [08:00] ... makuze intombi ngoku. {a girl must come now!}
42. Learner: Five to the power of two divided by five .. five to the power of one.. five to the power of one [Various learners prompt the learner at the board.] [09:00]
- 08:35 43. Teacher: Ngubani lo umenzayo wena? {Which number are you doing?}
44. Learners: Ngu F {it's number F}. [Learner writes $\frac{5 \cdot 5 \cdot 5}{5}$ on the chalkboard.] Five to the power of three.
45. Teacher: Akasoze aphinde avume {He will never agree again}, umntu osebhodini {the person on the board} don't talk. Iright? {Is this right?} [The learner has written down the steps of the problem, with some prompting from her peers. She concluded with the solution 5^{-2} and asked the class whether her answer was correct.]
46. Learner: Ha-ah ... Khupha unegative. {Take out the negative sign} [Learner erases negative sign, so the answer reads 5^2 .] [10:00]
47. Teacher: Why eright u-negative two? {Why is negative two right?}
48. Learner: Andiva miss {Can't hear you miss}
49. Teacher: Why eright u-negative two? {Why is negative two right?}
50. Learner: Kaloku bendi-subtracte u one {Thing is, I subtracted one}
51. Teacher: Ngoku xa u-subtracte ngo one awunako ukuba no two. {when you subtracted one you cannot get two}
52. Learner: [mumbles]
53. Teacher: u-three minus one ayinako ukuba ngu minus two ngu two. {Two minus one can never be minus two, it is just two.}

08:38 54. Learner: Ewe miss. {Yes miss} [The teacher erases the equal signs between the steps of the learner's work and inserts columns between each step instead.]

55. [Another learner starts to write the next problem on the board - 4x4x4 . [11:00] On a prompt by a fellow-learner, it is changed to 444444. The learner takes about ⁴⁴ 3 minutes to do this.]

56. Teacher: This is the last one, ngunumber bani eyokugqhibela? {what number is the last one?}

57. Learners: H, H

58. Teacher: The next one must do number I and M, the next two will do I and M. Nê? {Right?} The last one.. I and M. [10:40]

59. [In the meantime the learner is still busy on the board: 444444 | = 4^6 | = 4. The learner awaits some ⁴⁴ guidance from her peers, and eventually abandons the sum and starts over, next to the sum. This time, instead of writing the steps horizontally, she works vertically.]

60. Teacher: Uneproblem? [14:04]{Do you have a problem?} How many 4's ezilapho eleft? {How many 4's are there on the left?} Cancelisha ke ngoku. {Cancel the others now} How many 4's left? Kushiyeke abangahi kengoku? {How many are left now?} [Again she gets stuck. At this stage the learner is unable to complete the solution and waits for prompts from fellow-learners.]

61. Learners: Bayi 4{There's 4}[15:15]

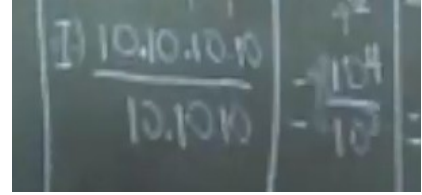
62. Teacher: That is because ubhale u4 apha and bangaphi aba 4 balapha?{How many 4's are there?}

[The teacher is explaining to the learner at the board.]

08:43 63. Learners: Bayi two{There's 2} [15:28] [With the assistance of the teacher, the denominator in the first attempt is corrected to 4^2 and the final answer in the second attempt, to 4^*.]

64. Teacher: [15:32] Number I and M ...

08:44 65. Learner: [Does the problem on board. $\frac{10.10.10.10}{10.10.10} = \frac{10^4}{10^3} = 10^1$] ...



66. Teacher: [17:00] Hayibo! {No ways!} How many tens, nah? Number M .. Number M .. Number M

67. Learner: I, I, I

68. Teacher: Hayibo! Bayi 3 ku I. {No ways! There's 3 in I}

69. Learners: Bayi 3 bayi 2 {There's 3, there's two}

70. Teacher: Ku I ngo3 akukho 10 ku I. {In I there's 3 there are no tens in I}

71. Learner: Bayi 3 bayi 2 {There's three, there's two}

72. Teacher: Ingo 3 {There's 3 in I}

73. Learner: Ngu L lowo miss umxelayo. {That is L you are talking about miss.}

74. Teacher: Kanti nikunumber bani na nina? Ngu L? {which number are you in?} {it's L}

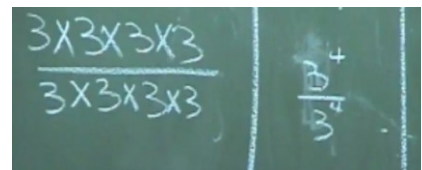
75. Learner: Ku I {on L}

76. Teacher: Ndifuna u M. {I want M} Number M .. Number M [There is confusion about which sum is to be done. Teacher repeatedly tells learners it's Number M, with learners responding in the background.] Ngubani emva ko K? {What's after K?} Ngu L? {It's L} [18:00] Ngu L and M {It's L and M}. Bendifanele ukuba {I was suppose}, benditshilo njena ngu L and M {I did say L and M}. Yes not I. Yi mistake ndithe ngu L and M {It was a mistake I said L and M}, L and M, L and M. Uzokwenza eyiphi nkwenkwe? {Which one are you in to do, boy?}

77. Learner: L no M {L and M}

78. Teacher: Ndifuna ibenye {I only want one.} Yes, nokuba wenza u L nokuba u M, ndifuna ibenye. {Yes, you can either do L or M, I just want one.} Bona ukuba uzokwenza eyiphi? {See which one you can do?}

79. [Learner does the next problem on the board, while the teacher talks in the background.] $\frac{3 \times 3 \times 3 \times 3}{3 \times 3 \times 3 \times 3} = \frac{3^4}{3^4} = 3^0$ [20:00]



80. Teacher: Uright? {Is he right?}

81. Learners: No miss!!

82. Teacher: Uwronto phi? {Where is he wrong?}

83. Learner: Iright but miss apha ekugqhibeleni funeka amelanga uyifake ... {It is right but at the end he was not suppose to put ...}
84. Teacher: Bekufuneka ayishiye i-exponential. Zoyi 10 using the same base itsho mos i- {All ten are using the same base, it says so} Ungayi simplifier ke but still nokuba uyishiyile injevana iright because kuthiwa apha encwadini niyevani? {You can still simplify it, even if you leave it like that it is still correct, that is what the textbook says. Do you hear?}
85. Learners: Yes.
86. Teacher: Right, ufour bases are the same so it's three into four minus four that is why eno three into zero niyabona? {4 .. bases are the same, so three to four minus four is why he has three into zero, you see?}
- 08:48 87. Learner: Yes.
88. Teacher: Number M. [21:00]
89. [Learner does the next problem on the board. $\frac{10 \cdot 10 \cdot 10 \cdot 10}{10 \cdot 10 \cdot 10 \cdot 10} = \frac{10^4}{10^4} = 10^0$. Other learners giggle as he writes on the board.]
90. Teacher: [Whilst the learner is still busy with the above problem]: [21:28] And then take out your books. Page thirty one
Khawu khanselise {cancel} ... khawukhanselise inumerator kwi denominator {cancel the numerator from the denominator}. Cancel the numerator kwi {from the} denominator.
91. Learner: Ndiyigqhibile kengoku. {I'm finished now} [23:00] [After interjection by the teacher, the learner changed his answer to **10**.] Missing Xhosa speech
92. Teacher: Kaloku utsho naye {He said it himself}, uyigqhibile {he is done}. Try to assist them.
93. Learner: Ndicela ukubuza uyifumana njani ingena zero. {I would like to know how you get this without the zero.}
94. Learner: [24:00] Xolo miss, {Excuse me miss} kaloku iba the same as ... nhe... nhe... {thing is it becomes the same as .. hmm...hmm} i-exponents zapha ziyafana, {the exponent are the same} ne denominator ziyafana. {and the denominators are same.}
95. Teacher: ibase {the base}
96. Learner: ibase {the base}
97. Teacher: Ngeyiphi ibase? {Which one is the base?} Nokuba ubunokumbuza akayazi ibase. {Even if you would ask him he does not know what the base is.}

The image shows a chalkboard with two columns of work. The left column shows the fraction $\frac{10 \cdot 10 \cdot 10 \cdot 10}{10 \cdot 10 \cdot 10 \cdot 10}$ with a horizontal line underneath. The right column shows $\frac{10^4}{10^4}$ with a horizontal line underneath. This illustrates the simplification of the fraction to 10^0 .

98. Learner: Ibase miss, ngu 10 {The base miss is ten} [Learner corrects sum by inserting an exponent in the solution which now reads 10^0 .]
99. Teacher: Ibase ngu 10 {The base is ten}, then?
100. Learner: I-exponent ibe ngu4 ... ngu 0. {The exponent is four ... zero} [Learner at the board changes his answer to 10^0 .]
101. Teacher: Uyabuza lona njani?{how is he asking?}
102. Learner: Xolo miss akushiyeke nto xa ulantuka? {Excuse me miss, there is nothing left when you} ... xa ukhanselisha. {when you cancel.}
103. Teacher: Hayi kaloku xa ukhanselisha kushiyeke u one. ibangu one one one one one one and then.{no people, if you cancell you will be left with one one one one one one and then...?}

$$\frac{10^4}{10^4} = 10^0$$

- 08:53 104. Learner: Bhala i-exponent. {write an exponent}[25:00]
105. Teacher: Page thirty one... Page thirty one nika umntu itshokwe nkwenkwe...nika itshokwe umntu {pass the chalk to some one, boy!} Page thirty one, number .. simplify and give each answer with a positive exponent. Number 7 ... Simplify and give each answer with positive exponents. Number B ... Number E .. [26:00] three into four ..[T says something inaudible to a learner.] Number B .. [27:00] Multiplication, if you are multiplying you know the rule when the base are the same. What is the rule of multiplication with exponents? ... [The learner at the board seems uncertain of what he has to write. He takes about one and a half minutes. His problem relates to the position of the exponent – he has trouble differentiating spatially between a base and exponent. The teacher eventually corrects his sum.]
106. Teacher: Multiplication, what is the rule for multiplication when you are multiplying exponent? .. Hmmm?
107. Learners: [Mumbled speech]
108. Teacher: And then three and then four minus two and here? [28:00] .. Hmmm?
109. Learners: Plus one
110. Teacher: Hay bethuna!then ngubani i-answer? Abantu ngoku abayazi kodwa siqale ngayo imultiplication. {No, people! now you do not know but we started with multiplication}
111. Learner: Three to one
112. Teacher: [inaudible speech – relates to the fact that learners perform differently when it's first period.]

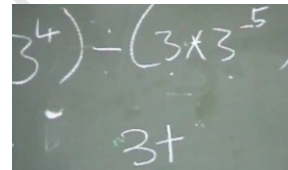
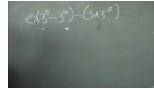
$$B. 3^4 \times 3^{-2} \times 3$$

$$B. 3^4 \times 3^2 \times 3$$

113. Learners: Three to one. (In response to teacher gesturing for an answer]
114. Teacher: Nenze njani? {How did you do it?} four minus two?
115. Learners: Two
116. Teacher: Plus one
117. Learners: Three
118. Teacher: Then it's three nê? {right?} into three. Then what is three into three? What is three into three? [T actually means /what is three to the power of three/. [29:00] If you are changing this into a number...if you are changing it into a number ngubani? {which number?}
119. Learners: Ngu one {it's one}
120. Teacher: Bangaphi aba 3? {How many three's are here?}
121. Learner: Ngu twenty seven miss [27]. {It's twenty seven miss.}
- 08:58 122. Teacher: Yho! {Pheew!} Number? Bendithe ngu number bani lento? {What number did I say this is?}
123. Learners: E
124. Teacher: Number E, Number E, Number E .. Number E, gqhibani {finish up} [30:00]
125. Learner: [Learner comes up to the board and mumbles something in isi-Xhosa.
126. Teacher: Number E, E, number E [T. Indicates to the learner that he is writing the wrong problem down.]
127. Learner: [Learner does the next problem with prompts from members of the class. $(3^p + 3^q) + (3 \times 3^r)$ He starts the simplification and writes 3^{p+q} but others make him change it to 3^{p+q} [31:34] .. it gets changed back to 3^{p+q} .. then it becomes 3^{p+q+r} ... as a results of prompts from other learners, this is changed to 3^{p+q+r} , then back to 3^{p+q+r} .. at which point the teacher intervenes. Once again, the answers are recruited from the rest of the class]
128. Teacher: [32:30] Simplify the first bracket and simplify another bracket. Don't combine them because uzoba lost. {you will get lost} Uzicombine kwi step soku {Combine them on the next step} to the last step. So izakuba ngubani i-answer pha? {So what is the answer there?}
129. Learners: Five
130. Teacher: Hmmm?
131. Learners: Three to the power of five.

Generally the learners struggle to copy a problem from their books onto the board

132. Teachers: Uyekwelandelayo ngaphayana. {Go to the next one on that side} and then kuleyana ngubani? {what is that one?}
133. [Learner continues to write on the board with the help of other students.]
134. Teacher: Umfumene njani uPlus five? {how did you get plus five?} lo plus five umfumene njani? {how did you get this plus five} [34:50] This one is division and this one is ..?
135. Learners: Multiplication
136. Teacher: So where do you get the positive five? Because it say it's positive. Five is having negative. Nê. {Right?} Hmm? [35:20] This is multiplication, this side is multiply, this one is division so the rules are not the same. You know the rule of multiplication and you know the rule of intoni? {what?}
137. Learners: Division
138. Teacher: So where do you get to this part? Nonke nithe ngu five nimyekile njena. {You all said five and let him write five} [T points out that the first bracket involves division but the second bracket involves multiplication, thus $3^{1-5} = 3^4$. [35:53] Another learner attempts to solve the problem but is not successful.
- 09:03 139. [36:52] The siren wails for the end of the period, and the problem is not completed.



[School P3 Lesson 1]

Time	#	Speech	Notes and comments
		<p><i>The teacher conducted her lesson on {rational and irrational numbers}. She started on by asking the learners a question.</i></p>	
00:00	1	<p>Teacher: – Ibenento iphinde ibenzentoni enye into, {What other things do they do?} <u>except utshintsha ibe yi fraction kusabezethini?</u></p> <p>{We can expect them to change to fractions} You can write or express them in a form of fraction ne irrational numbers.</p> <p><u>Yeyiphi enye into eziyenzayo irational number ngaphandle kwalanto?</u></p> <p>{What other thing do rational numbers do except for that} <u>Khandinike isymbol ye rational number.</u></p> <p>{Give me a symbol for rational numbers.} <u>Besithe xa sifuna siyipresenter kanjani kanene?</u></p> <p>{We said if we want to represent it, how do we represent it again?}</p> <p>1. Learner: Ngo Q [with Q].</p> <p>2. Teacher: <u>Ngo Q , nê?</u> {With Q , right?}</p> <p>3. Learners: Yes, miss.</p> <p>4. Teacher: Siyi representer irational number ngo Q phayana, {We represent it with Q there} then ke ngoku besiyé pha kwi number zonke that can be expressed that can be written in a form ifraction. {then now we can go to all the numbers that can be written in a form of fraction} Fraction that has (a) → Numerator and (b) → Denominator.</p> <p>5. Learners: Denominator</p>	<p><i>She was referring to numbers she told learners about but the video did not pick them up.</i></p> <p>Teacher wrote (s/b) on board: Rational numbers → Q</p> <p>Rational no: → Q</p> <p>$\{ \frac{a}{b} \}$</p> <p>Teacher wrote (Irrational numbers by Q', a/b)</p> <p><i>She asked learners referring to what she wrote on the board</i></p> <p><i>Teacher added: {a/b} on board</i></p> <p>Rational numbers → {a/b}</p>
01:00	6.	<p>Teacher: They can be written in a form a fraction.</p>	

7. Learners: Fraction. *(learners were reciting/saying louder)*
8. Teacher: that is $|a|$ over $|b|$ njalo, njalo { a/b , etc} or $|eks|$ over one njalo, njalo { $x/1$, etc} and also ngeziphi ezinye inumbers? {which other numbers?} Khange sithethe nge numbers ezikwazi ukuba zirational numbers. {we did not discuss numbers that can be rational numbers.}
9. Learner: Ziintegers. {It's integers} *They said very loud*
10. Teacher: Iintegers zinumbers ezitheni kanene? {What are integers again?} Positive and Negative.
11. Learners: Negative.
12. Teacher: Then all phayana ... iintegers also apha ... then all nalapha ... they fall phayana.
 {Then all integers there ... also here ... then all fall there.}
 Then ke ngoku phayana {then what about there?}
 we are going to see i-difference between i-rational {rational} and irrational numbers}.
Niveva? {Do you hear?}
Siyeva phayana ukuba irrational numbers zona zibhalwa ngokwahlukileyo phaya kwi rational numbers siyevana?
 {Do we agree that irrational numbers are written differently to rational numbers?}
Lanto efakelwa phayana ilichaphaza uzobona umehluko ngaphakathi kwazo, xa irepresentwa pha ubona la symbolism injena ithethe ntoni?
 {the dot we put over Q shows irrational numbers., what does that symbol mean to you?}
13. Learners: - No it carries on.
- 02:00 14. Teacher: - Irrational numbers can not be written in the form of fraction, they don't form any kind of a pattern/sequence, e.g $\sqrt{2}$. *She said repeatedly*
 Q' → Irrational numbers: can not be written in the form of fraction, they don't form any kind of a pattern/sequence, e.g $\sqrt{2}$.
 What is the value of $\sqrt{2}$, class?
15. Learners: - 1 comma 4
16. Teacher: - Right - Look to examples: Irrational number gives an answer that is infinite. siyevana? {Do you understand?} *(she wrote $\sqrt{3}$ on the board)*
 Khaniyenze kwi calculators yakho pha then nindinike ianswer
 {do this on your calculators then give me the answer} Teacher writes:
 Example

then we are going to work together nabantu abane calculator nisebenzisane phayana nindenzele unumber 1 esa {work with people who have calculators and do number 1 for me, that ...} square root, isquare root of 3 undinike ianswer epheleleyo siyevana? {and give me the full answer do you understand?}

Eg $\rightarrow \sqrt{3} = 1,732050\dots$ is infinite \rightarrow goes on and on not one number.

1. $\sqrt{3}$

$\sqrt{3} = 1,732050\dots$

17. Learners: Yes Miss. 1 comma 7 3 2 0 5 0 8 0 8

18. Teacher: - What is $-\sqrt{12}$?

She asked

Teacher wrote: 2. $-\sqrt{12} = 3,4610$

19. Learners: $\rightarrow 3,4610\dots$

They got the answer from their calculators.

20. Teacher: -You cannot speak as a mass choir. Iphelele phayana? {Does it end there?}

Commanded them to rise up hands

21. Learner: - No it continues.

22. Teacher: -Yes it continues. right? {so let us check those examples that are there at the bottom, do you understand?}

She was trying to get feed back from learners

03:00

23. Learners: Yes

24. Teacher: The number on the right hand side goes on and on, have you noticed?

25. Learners: Yes

26. Teacher: - Iripiteke {It get repeated} but this one yona ayikwazi ukunika i-answer erikherishayo {it cannot give you a recurring answer} i-answer zakhona azirikheri and azifomishi pattern siyevana? {The answers do not form any pattern, do you understand?}

27. Learners: Yes

28. Teacher:- Number 3, $\sqrt[3]{28}$ siyevana? {do you understand?} Khaniyenze kwi calculators yakho pha then nindinike ianswer {do this on your calculators then give me the answer} then we are going to work together nabantu abane calculator

04:00

04:50

Nisebenzisane phayana nindenzele unumber 1 esa {work with people who have calculators and do number 1 for me, that ...} square root,

- isq of undinike ianswer ephelleyo siyevana? {and give me the full answer do you understand?
29. Learners: Yes Miss
30. Teacher: Yimani kuqala ndiyibhale pha ebhodini nê? {Wait let me first write it on the board.} Teacher writes on the chalkboard
31. Learners: Yes Miss
32. Teacher: Khandinike isquare root of 3 nê? {give me the square root of 3}
33. Learners: 1 comma 7 3 2 0 5 0 8 0 8 1 comma 7 3 2 0 5 0 8 0 8
- 05:00 34. Teacher: Okay, Okay niyabona ukuba la answer ninayo pha ayi termineti? {Do we see that the answer does not terminate?}
- Ikunika ianswer ene number ezininzi {It gives you a lot of numbers} 1 comma 7 3 0 5 0 then iyaqhubeka and ayina {it continues and does not have} pattern awunayo kuyilandela uthi the next number ngoku izakuba yinumber ethile.
- Siyevana? {You cannot predict the next numbers.} Awunokwazi ukuyiqikelela ayifani napha kwi rational numbers apho ubone ukuba there is a pattern nokuba inumber yakho ayithini???
- {You cannot guess it, unlike rational numbers where you sometimes spot a pattern even if the number does not? }
- Mhlawumbi kukhona inumber ezirikherishayo. {maybe there is a number that recurred}
- Yona ayi rikherishi ikunika nje ianswer ezininzi siyevana? {it does not recur but just gives a lot of numbers}
- Do you understand?
35. Learners: Yes Miss
36. Teacher: Masikhe sijongeni pha la {let's look there} All learners speak at the same time negative square root ka 12 ianswer yakho pha oyifumeneyo. {the answer that you got here}
37. Learners: 3 comma 4 6 1 0 ... Teacher writes: $2. -\sqrt{12} = 3,4610$
38. Teacher: Anina kuthetha nonke nje, nindinika njalo. Teacher now writes in the negative

{you cannot all speak at once, don't give it like that}
It's negative 3 4 6 1 0

sign (minus sign) and continues: –
3,4 6 10 16.....

06:00

39. Learners: 1 6

40. Teacher: Njalo njalo iyaqhubeka yinumber ende ezinye
mhlawumbi azipheli phayana.
{etc, etc it continues, there are many numbers others might
not even
end there.}

Njalo njalo. {etc etc} Isquare root, icube root, yintoni la
number?

{what is that number} Z
Ibizwa ukuba yintoni kanene eno 28?
{What do they call that with 28?}

41. Learners: Cube root

42. Teacher: It's a cube root, cube root of 28. Who can find
ianswer
ka tube root of 28?
Kufuneka sijonge ianswer {we must find the answer}
yimake khawume ndiqale ndizibhale ezinto, {wait let me
first write
this} tube root of 28 ilingana nabani {what is the equivalent
of} icube
root of 28?

Teacher writes:

$$3. \sqrt[3]{28} =$$

43. Learners: {Mumble}

44. Teacher: Number 3, $\sqrt[3]{28}$
siyevana? {Do you understand?}

Teacher wrote: 3,036

Khaniyenze kwi calculators yakho pha then nindinike
ianswer

And continues: 3,0365899

{Do this on your calculators then give me the answer}
then we are going to work together nabantu abane calculators
nisebenzisane phayana nindenzele unumber 3

{work with people who have calculators and do number 3
for me,

She asked them

that ...}, $\sqrt[3]{28}$. Undinike ianswer ephelileyo siyevana?

{And give me the full answer do you understand?
3 commas?

45. Learners: -Zero comma????

46. Teacher:- 3 comma 06?

47. Learners:- 65899

48. Teacher:- So uyabona ukuba {so you see that} it is wise into yokuba
wonke umntu makabenayo icalculator? {for everyone to have a calculator}
49. Learners: -Yes Miss
50. Teacher: Because ngoku {now} you can't just estimate uthi hayi
{and say no} square root sika bani {of this} awuzu {you won't} you
won't know ianswer without using icalculator nê am I right?
51. Learners: Yes
52. Teacher:- So it is very wise into yokuba {that} wonke umntu abenayo {every one has a} icalculator azokwazi ukutshika icube
root njalo njalo
{so you can check square roots ect ect}. Then siye phayana sijonge
pha.
{then we go and look there}
Yintoni kanene unumber 4? {What is number 4 again?}
Who can tell me? What does that symbol represents in number 4?
53. Learners: - π *Teacher wrote: 4. $\pi =$*
- 07:00 54. Teacher:- π nê?
55. Learners: - Yes
56. Teacher: - π , Khawube undilantukela..... pha kwi scientific
calculator if uyayi yenza pha izakunika ianswer nê?
{please do that on the scientific calculator if you can and give me
the answer}
- Learners should find the value of π in their scientific calculators*
57. Learners: Yes
58. Teacher: Kha undi nike ianswer pha uqale kwi π .
{give me the answer and start with the π }
Sidla ngoku yisebenzisa for ukwenza ntoni kanene i π ?
{What do we use π for?} Where do we normally use that symbol π ,
when we calculate?
59. Learner: In circle
60. Teacher:- We use it to calculate icircle? *She asked*
61. Learners: Circle
62. Teacher: So ithini pha ianswer oyifumanayo xa usenza I pi? *Teacher wrote: 3,14*

- {what answer do you get when you calculate π ?} 3 comma ?
63. Learners: 1 4 *The learners finish the sentence*
64. Teacher: Iyaqhubeka kaloku. It continues *She said*
65. Learners: {Mumbled} *They could not come up with the full answer.*
66. Teacher: Aniyifumenanga? {Have you found it?} Abo bane {who are those?} Those with calculator or scientific calculator.
67. Learners: {Mumbled again}
68. Teacher: - 1 5. khawubachazele {tell them} how did you get the value of π ? *Teacher continues with the expansion of decimals of the value of π .*
 Abanye abo banayo {others don't have scientific calculators. *3,141592*
 If you dont have scientific calculator ezinye icalculator ezi normal
 {The other normal calculators} they cannot give you ilantuka
 baxelele kaloku wenze njani?
- {Please tell them how you did it} How did you get your answer kwi π ?
 Nge {with} second function
 Bethunana siyevana? {People do you understand?}
69. Learners: - Yes
70. Teacher: - Inoba {maybe} you forget because in grade 8 you were *The teacher seems to forget what she wanted to say to learners*
 taught about using a calculator.
 I believe inantsika inantsika..... {that thing}.
- Usecond function . Upressa inumber yakho uye kwi second function *She put an emphases on how to us scientific calculator*
 phayana. {you press your number then go to second function.}
 So kwaba bangenazo icalculator {to those who do not have calculators, it will be difficult to know how to find the value of π .
 ukuba yenziwa kanjani {how you do this}.
- Funeka uyipractise kwi calculator yakho.
 {You must practice using your calculator.}
71. Learners started making a noise. *Teacher added a dotted line after the last number on the existing decimal approximation of π .*
3, 141592.....

- 09:00
72. Teacher: - ‘Shuuuuu’ *she exclaimed*, Mamela ke nê? {listen}
 okay masipheze kengoku nê?
 {Can we stop now the noise please?}
 Can we listen now? Into eyenzekayo ke ngoku
 {what happens now}
 if you can see phayana kula nto yenzekayo
 kweza answer zethu zeza.....
 {what happens to our answers is: the value of $\sqrt{3}$, $\sqrt{-12}$ njalo njalo
 {etc etc} up to that π , iroot ianswer esizifumanayo azina

 {the answers we get do not have pattern and it does not terminate,
 that is why those numbers sithi kuzo
 {We name them as irrational..... Ntoni? What?
73. Learners: - Numbers
74. Teacher:- There are irrational numbers, So the easiest way we can write irrational instead of writing those full answers {Your long numbers and you have to estimate and round off}.
 i.e. to write to the nearest or two decimal places.
 Do you understand?
75. Learners: - Yes
76. Teacher:- Like there in the example, the one in page 9. *She was explaining the rounding off process*
 They say correct number to 2 decimal places
 Siyevana? {Do you understand?}
 Because ku avoidwa into yokuba ubhale into ende phayana engapheliyo nê? {They are trying to avoid writing long numbers}
 enga terminatiyo siyavana?
 {That does not terminate, do you understand?}
77. Learners: Yes miss
78. Teacher: We know this in grade 8 on how to write numbers to 2 decimal places, to 1 decimal place, to 3 decimal place and so on.
 Let’s do few examples of this before you write them on your books. *Teacher wrote 3 decimal places number on board.*
 Let’s look there where they say we must do 3 decimal places.
 {So we can practice and what we are going to do is that when we write it into 3 decimal places, we must have 3 numbers after the comma.
- 10:00
79. Learners: I comma

80. Teacher: I decimal comma, asizi kuyenza into
 {we are not going to do 2 decimal places, then we write as 1
 comma
 7 3 before 2 before we write our last number because we
 write to 3
 decimal places. Ie 1,732
- Teacher also writes:
 1,73
 By referring to example 1, the
 decimal expansion of $\sqrt{3}$ is 1,732
 ie 3 decimal places.*
81. Learner: - Ela nani eliyana lisecaleni kuka 2 lingagqithi
 ku 5. {
 If the number next to 2 is not more than 5)
- Now teacher refers to example 2 on
 board, as (and immediately after)
 the learner responded, #82*
- 11:00 82. Teacher: Ehmm, If ela nani lethu phayana lingu 5
 { If our number is 5 or more}
 Which is ke ngoku la 2 wethu {which is 2 in our case}
 izakuba *Translation done*
 ngubani?
 {What will that be?} Izakuba ngu 3, {it is going to be 3}
 but into eyenzekayo ke ngoku inani lethu lenza ntoni?
 {What happens to our number?}, So xa li less than phaya ku
 5.
 {So if it smaller than 5}. {Then it means} liza kuhlala
 linjeyana alizuku
 tshintsha.
 {It will remain the same}. Ngela hlobo litshoyo phayana.
 Uzobhala ke
 ngoku 1 comma 7 3 2 { pit does not change, you will write as
 1, 732}
 siyevana? {Do you understand?
83. Learners: - Yes
84. Teacher: Masijonge naleyana siyise kwi 2 decimal or ku 3.
 uright u3 *She led learners to 3 decimal
 numbers
 by convincing.*
 nê?
 Let us look up there and try to change it to 2 decimal or 3
 decimal
 numbers. 3 decimal is right, is it so?
85. Learners: - 2
86. Teacher: Niyifuna ku 2? {Do you want 2?} Okay fine, le
 sizakuyitshintsha {change to 2 decimal places} *She asked the learners*
 Which is sizojonga amanani amangaphi {how many
 numbers do we
 need after the decimal comma?}
87. Learners: {Mumble} and others say 2
88. Teacher: {2 numbers}. Funeka zibeyi 2 inumbers phayana *Teacher wrote: -3,4 on the board*
 so izakuba equals to negative 3 comma 4
 {there must be 2 numbers so that it become -3}but before
 sibhale ke
 ngoku ela xa siyenza to 2 decimal places sizojonga eliphi?

{but before we write this number to 2 decimal places, in which number are we going to look at?

89. Learner: 1
90. Teacher: - Sizojonga u 1 nê? {We are going to lookk at 1} understood?
sizojonga pha eli lesithathu ukuba lingakanani na
{We will look to the third one whether less or bigger than 5}
xa sibhala
kwi decimal places.
{if we write it to decimal place} So kwenzeka ntoni phayana?
{What happens there?}
Xa li less than 5? {if the number is less than 5?} Because la 1 utheni?
{What happens to that 1?}
91. Learners: uLess than 5
- 12:00 92. Teacher: uLess than 5 kuza kwenzeka ntoni ke ngoku pha ku 6? *{The error was made, 6 is not less than 5}*
[It's less than 5, then what is going to happen to 6?]
93. Learners: - Siza kumbhala enjeyana. { we will write as it is}
94. Teacher:- Siza kumbhala enjeyana asizomtshintsha u 6, *{Error continuous }*
{We are going to write it as is because the number is less than 6}
enjeyana is less than? 5
95. Learners: - 5
96. Teacher: - {Let's finish up by looking at 3, 03}... *Teacher wrote the number on the board: 3,03*
masiske sigqibezele
ujonge phayana. 3 comma 0 3 sizakuyenza to 2 decimal or 3?
Siyenze kwintoni? {We will change it to 2 or 3 decimal places, which one do you prefer?}
97. Learners: - 3
98. Teacher: - Siyenze kwi 3 decimal places so which means sizojonga
how many numbers after idecimal place? {Let's write it to 3 decimal places and try to notice how many numbers after the comma}.
99. Learners: - 3 numbers
100. Teacher: - Sojonga 3 so ibeyintoni? { we will look to 3 then what?} *Teacher wrote: 3,03*
3 comma 0 3 but before umbhale ke ngoku la 6 kuzofuneka sijonge
bani phayana? {Before we write 3, 03 - what should we look

at first?}

101. Learners: - 5
102. Teacher: - Sijonge lo 5 nê? {Let's look at 5, okay} so ke ngoku ela nani
ngu 5 kuzo funeka kwenzeka ntoni ke ngoku pha? {From that number
5, what is going to happen there?}
103. Learner: - Faka u 1 linyuke {add 1 to make it bigger}
104. Teacher: - Lizo increaser and then we add u1 ngaphayana nê?
{add 1}
105. Learners: - Yes
106. Teacher: - 3 comma 0 3 7. lena siyiyenza 2 decimal? {Is this 2 decimal?} *Now Teacher continued with previous note #100: 3, 037*
107. Learners:- 3 decimal nokwayo [this is 3 decimal]
108. Teacher:- Nifuna ukuthi 3? {You want to say 3?}
109. Learners: - Ewe {yes}
110. Teacher:- Masenzi 2 {lets change to 2}
111. Learner: Uxolo madam {excuse us madam}
- 13:00. 112. Teacher: If uyibuze, {asked} uyamamela ukuba kuthwa yitshintshe to how many decimal then siyitshintshe pha, {you follow
the instruction on which decimal are we required to change to}
masiyitshintshe into 2 nê? {let's change it to 2 decimal places}
izakuba ngubani kengoku phayana? {What will be the answer now?
Uzakuthi 3 comma 1 4 {3,14}
113. Learners: - 3 comma 1 4 {3,14} *Teacher wrote 3 on the board,*
114. Teacher: - Then uyajonga kweliyana lesithathu into yokuba li less
than or more than 5 na,
{look at the number whether its less than 5 or not}
iles than 5 uzothini phayana?
Then {if it is less what are you going to do?} *Teacher wrote 3,14*
Asiyi kutshintsha, {we won't change it} *Teacher points at some work to be done*
Then nizakwenza le ngoku. Yinto enjeya.....

- 14.00 115. Teacher: Bakhona aba bangayenzanga neh?
 {There are those who did not do it, neh?}
 Learners: Yes
 Teacher: Masisebenzise I {Lets use our }calculator zethu
 because its
 easy icalculator
 yakho does the work for you neh? Its just uku pressa pha.
 Asizohlala, besizama ukujonga la manani azi
 {We are not going to take long we are just looking at the}
 rational
 and irrational numbers .
 I rational numbers are numbers that do not terminate.
 They cannot be expressed in the form of fractions instead
 bakwazi
 ukuwa roundisha off
- 14:44 116. Masijonge kwi ratio ukuba what is a ratio? *The teacher started the Ratios*
 {Idefinition of a Ratio} pha, ngubani ozakusifundela ye
 ratio?
 {Who is going to read from the definition of the ratio from
 the book?}
 Funda Nosiphiwo {read Nosiphiwo} Qala ufunde pha
 ideofinition *The teacher pointed one girl in
 class: Nosiphiwo by name.*
 yeratio. Qala kupage 9. {Start at page 9}
117. Learner: Find the ratio numbers of two numbers *Learner's read from the book*
118. Teacher: Ndicela ufunde ideofinition of a ratio
 (read the definition, not the question)
119. Learner: The ratio is.....
120. Teacher: Same page kaloku page 9 {same page please}
121. Learner: The ratio is a relationship between 2 numbers *She read*
 from ...
 quotient divide by another.
- 15.06 122. Teacher: iquotient, quotient kanene inoba yintoni? [
 What is the quotient in actual fact?} *She asked learners repeatedly*
 Inoba yintoni kanene quotient?
 Licingisa ntoni ela gama? {What do you think of this word?}
 Yi answer yintoni? {It should be the answer we get when we
 use one
 operation, Which one?}
123. Learner: Division
124. Teacher: Division nê? {Division okay?} i answer phayana
 iratio.{answer is the ratio}. Iratio is a relationship between 2
 numbers or
 equalities, ezi expreswe phayana ezi mejasrishwe nge same

Then ilength yakhona is 120 metres so bafuna ke ngoku iratio

yaphaya siyevana?

{Find the ratio?} Inoba ingakanani la rugby field if injeyana?

{How big is the rugby field?} Phayana uyakwazi ukuyi expresser lanto

xa ufuna ukubhala lento in a form of a fraction.

{you can write the ratio in the form of fraction}

127. Learners: Fraction

128. Teacher: So la 50, la 50 mos pha besithe ngowantoni?

{ what is that 50 for?}

Ngo we breadth nê? {breadth okay?} naxa simbiza

phayana la 50 xa simbhalayo sithi 50 is to siyevana?

{If we call out or write that 50 we say 50 is to-----?}

19:00

Xa uyibhala pha uyabona ndenze ntoni?

{notice what I have done when you write it} 50 is to 120 metres

siyevana? {50 : 120, understood?}

50 is to 120 eh le yana into uyakwazi uphinde uyibhlale in a form of a fraction kuba kaloku iratio phayana {the above ratio can

also be written in the form of fraction}

xa besichazela kufuneka uyibhale in a simplest form. {can be simplified} So you must simplify iratio niyeva?

→teacher called the name Funeka.

{understood} Funeka, you always simplify iratio yakho. Anditsho besiyi

simplify ngoku besisenza besiconverta efraction?

{we did simplification when we were busy with conversions}

$$\rightarrow 50/120 = 5/12$$

Xa sifuna ianswer yethu phayana kwi common fraction besisithini?

{looking for an answer to common fraction, what did we do?}

Besi simplifier ianswer yethu, bhala in a simplest form.

{we simplify our answer} So iratio yethu 50 into 120 iyakwazi

ukubhalwa into a fraction nje njo 50 into?

{our ratio 50 : 120 can be written in the form of fraction as 50----}

Sorry..... divide 50, over 120 siyevana? {sorry 50/120}

Njenge fraction then ifraction yakho uyi simplifaye.
{then simplify this fraction} Siyakwazi mos ukusimplifier?
{Can we simplify it?}

129. Learners: Yes Miss

130. Teacher: Siyatsheka phayana ukuba sizo divider ngantoni
phayana naphayana at times uyakwazi ukudivider ngela nani
ngentla naphi?

{we are told that we need to divide which number by the
one
written above?}

Nangezantsi so pha kumela sidivider ngobani sizo fumana la
answer

iphelele? {Which number are we going to use to divide
below to get

complete answer?}

131. Learner: Ngo 10 {10}

132. Teacher: Ngo 10 nê? So udivider ngo 10 phayana ku 50
izakuba

ngubani? {50/10 = ----?}

Teacher:

$$50/10 = ?$$

133. Learners: 5

Responded correctly

134. Teacher: Izakuba ngu 5 divider ngo 10 pha ku 120
yangubani?

*Error again: 5/10 is incorrect,
suppose to be 50/10*

{That will be 5/10, then what about 120?}

135. Learners: 12

Responded correctly

136. Teacher: Yangu 12 siyevana? {It's 12 okay?} Can we
simplify this

further?

137. Learners: No

138. Teacher: No, anikwazi ukuphinda sisimplifaye because
there is no

20:00

number enongena ngentla naphi? {cannot be simplified
further

because there is no number that can go in above}.

Nangezantsi niyaqonda? {below as well, okay?}

So ikwi simpliest form yayo phayana. {it is in it's simplest
form now}

Masikhe sjonge the next example before siye pha
emsebenzini

esiwunikiweyo.

{let us look to the next example before the exercise}

Nantsi enye i-example phayana {there is the other example}
not

always kuzothiwa simplifaya iratio it's abut usimplifier
okokoko nê?

→Teacher wrote 23 boys in a class
of 41 learners.

{the ratio can not be simplify continuously} at times
uyakwazi
ukinikwa iproblem but you must have to read instruction
ukuba

*Should be: write the ratio of boys
to girls after getting the number of
girls in class.*

kuthiwani

{if you are given a problem, read instructions carefully} for
example

There are 23 boys in class of 41 learners, calculate the ratio.
Okay,

calculate the ratio of the number of boys to the number of
girls in the
classroom.

So unikwe pha amakhwenkwe mangaphi? {How many boys
given?}

139. Learners: ayi 23 {they are 23}

Correct answer

140. Teacher: ayi 23. inumber yonke xabephelele bangaphi?
{how many learners in total?}

141. Learner: Bayi 41 {41}

142. Teacher: Bayi 41so uzokwazelaphi ke ngoku? How are you
going

to know into yokuba ama girls mangakanani kuma boys?

{How are you going to find out the number of girls to boys?}

143. Learners: Yile ashiekileyo

$41 - 23 = \text{-----}$

{the number left when subtracting 23 from 41}

144. Teacher: Le ishiyekileyo, which means le ishiyekileyo
uzoyazi

21:00

ngokuba mawuthini? {How are you going to get the answer
then?}

Teacher told the class

Usubtracte, uminuse siyevana? {Subtract, okay?} So yile nto
phayana

kuye kwa subtractwa la 23 kula 41 yazoba ngubani? {41 - 23
= ----?}

Boys : Girls

Ngu 18. yabhalwa nantsiya ianswer yakho the boys, there are
23 boys

23: 18

and 18 girls.

Xa ibhalwa pha it's 23 is to {we write as 23: 18

145. Learners: 18

146. Teacher: 18 siyevana? {18, understood?} Masitsheke pha
iexercise

page 13. {Let us check exercise on page 13} kuthiwa
simplifier

phayana andithi?

{They say simplify there am I right?} Simplifaya the
following ratio's u

→ Where does 20 come from?

18 is to 20 {18:20} akonto pha ozoyijika uzobhala phayana
as a a

- fraction {you cannot change anything but only to write it in a fractional form} then uyitshintshe uyibhale, uyisimplifaye nê?
 {Simplify it only} ikhona into enzima phayana? {Is there anything difficult?}
- 22:00 147. Learners: No miss.
148. Teacher: Xa sibhlala as a fraction la ratio pha u18 is to 20 izakuba ngubani? {if we write the ratio→ 18:20, how can we convert it to a fraction?} As xa siyibhala into fraction izakuba ngubani?
She repeated one thing.
149. Learners: 18 over 20 {18/20}
150. Teacher: Ngu 18 over 20 nê? Then simplifaye siphinde siyibuyisele as a ratio siyevana?
 {We can also simplify and convert it to ratio} u-B wakho unikwe eyiphi inumber pha? {What number is B there?}
18/20 THE TEACHER SAID
151. Learners: {Mumble}
No clue to learners
152. Teacher: Funda kaloku. {Read please!}
She strongly commanded the learner.
153. Learner: 300 is to 150 {300 : 150}
154. Teacher: 300 is to 150, so kuzofuneka uyi converte uyise kwi fraction or if uyakwazi ukutshintsha uyisimplifaya ikula form ikuyo.
 {you need to convert it to fraction or simplify it in that form}
 Then ibengu 45 into 6 {became $\frac{6}{45}$ } uzokwenza kanjeyana masiyeni
 ku number 2 ngulo ndiqonda ukuba uzosixaka lo, uyambona unumber 2?
 {Let's go to number 2, but I understand that it might give us problem.
 Can you see number 2?}
*45 into 6
 Will mean $\frac{6}{45}$ I suppose*
155. Learners: Yes
156. Teacher: Kuthiwe ku number 2, divide the following numbers into each of the given ratio's, divider ezanumbers into each of the given.
Teacher was reading the instruction from the book
157. Learner: Ratio's
- 23:00 158. Teacher: So sidibanisa pha u4 wakho {add 4} then we will do together u A and try kengoku ukuzenzela u B njalo njalo. {try B and others} So u A is 1000 in the ratio of 2 is to 3.

{1000 is the ratio of 2:3} So yintoni ke ngoku esizoqala siyiyenze

phayana?

{What will be our first step?} Ngubani umntu onosixelela okanye

ndizenzele ngokwam? {Any volunteer or shall I do it myself?}

Kukho umntu ofuna ukutraya mhlawimbi kuthiwa masithini phayana?

Learners could not understand what to do.

{Any one who wants to try? Sizo divider? {Are we going to divide?}}

Okay let me give you iexample ka A phaya.

{let me give you example A} Ungayizama mos lento pha?

{You can try it out, okay?}

159. Learners: Yes Miss

160. Teacher: Ndizokwenza u A yedwa phayana {I'll do only A there}“divide the following numbers to each of the given ratio's.”

Teacher first clear board, then writes (as she reads):

umnikiwe u-A wakho phayana nê? {you are given A, there okay?}

Exercise 3

a) 1000 in the ratio 2:3

1 thousand in the ratio nijonge ke ngoku kakuhle phayana

{look carefully there} because yinto entsha lena I don't think sakhe

sayiyenza before.

{this is new to us} pha l 1 thousand kuthiwa masidivide ratio ka 2 into 3

siyevana?

{divide 1000 to a ratio of 2:3} enye into esiza kuyiyenza phayana

ungayenza ukuba u-edisha la 2 nala 3 xa sim-edisha

sizofumana bani? {We can add 2 and 3 together, and then what will

be the answer?}

161. Learners: 5

162. Teacher: 5, kuba kaloku sifuna sukubhala la 2 in a form of a fraction nala 3 in a form of a fraction siyevana?

Teacher explains as given in transcription but refers to the chalk board note in (a), #159

{because we want to write 2 and 3 in the form of a fraction}

then ke ngoku kula 5 wakho sizomenza idenominator yethu

{we will make 5 our denominator}

because sifuna ukubhala ntoni? {What do we want to write?}

Leyana into in a form of a fraction. {as above in a form of fraction} So into esiza kuyenza pha xa ubhala 2 in a form of a fraction idenominator ingu 5 izokuba ngubani?

{now if we happen to write 2 in the form of a fraction with denominator 5, how will the fraction look like?} 2 over? {2/-----?} 5 kaloku idenominator xa uqibo edisha pha izobe iyi

24:00

denominator yethu leyana, akukho njalo? {5 is our denominator, is it not so?}

163. Learners: Yes

164. Teacher: The ke ngoku i-answer, {that is the answer} ifraction yethu

yokuqala izokuba ngu 2 over 5 {our first fraction will be 2/5} sorry. Then

ifraction eno 3 izakuba ngubani? {What will be the fraction with 3?}

Teacher: $\frac{2}{5}$

165. Learners: 3 over 5 {3/5}

166. Teacher: 3 over 5 nimamele nê? {3/5, are you listening?}

Teacher wrote: $\frac{3}{5}$

Now is have written: $\frac{2}{5} \cdot \frac{3}{5}$

167. Learners: Yes

25:00

168. Teacher: Then ke ngoku xa sibhalile phaya as 2 over 5 no 3 over 5

funeka sithayimzile ngala one thousand siyevana?

{As we wrote 2/5 and 3/5 then we must multiply both by 1000, okay?}

Teacher wrote: $\frac{2}{5} \times \frac{1000}{1}$

kuba kaloku kuthiwa masibhale pha la thousand in a form of a

fraction siyevana?

$\frac{2}{5} \times 1000$

{because they say we must write 1000 in the form of a fraction, are

$\frac{3}{5} \times 1000$

we together?}

so uzokwenza ifraction nganye phayana because funeka ifraction

ibeyi part of la 1 thousand siyevana? {you need to separate both

fractions because each fraction has to be part of 1000} then into

esiza kuyiyenza phayana siqale ngala fraction le yana yokuqala 2

over 5 uthayimze ngabani?

{Which number are we going to use to multiply the first fraction?}

169. Learners: 1 thousand

170. Teacher: u1000 yi whole number izakuba over bani?

$\frac{2}{5} \times \frac{1000}{1}$

{1000 is a whole number and it will be divided by which number?}

171. Learner: 1

172. Teacher: Over 1 siyevana? {okay?} sisenokuyiyenza ngendlela

esiyiqhele ngayo xa sithayimza ifraction siyayazi sonke?

{we can use 1000 as we know when we multiply the fraction without

dividing it by 1}

Sidla ngokuthini kanene xa sithayimza ifraction?

{What do we normally do when multiplying the fraction?}

Siyithayimza njani ifraction? {how do we multiply the fraction?}

Siya thayimza kaloku asizokuyi divider.

{we use multiplication but not division}

Siye sithayimze inumerator zodwa siphinde sithayimze ntoni?

{We multiply both numerators then followed what----?}

173. Learner: idenominator zodwa {denominators as well}

174. Teacher: So sizokuthini pha? So what do we say next?} 2 times?

{2 x ----?}

175. Learners: 1000

176. Teacher: Izakuba ngubani u 2 times 1000?

{what will be 2 x 1000 = ----?}

$$\text{Teacher: } \frac{2000}{5}$$

177. Learners: Izakuba ngu 2000 {that will be 2000}

178. Teacher: Over? {Divided by ---?} 5 times 1 izakuba ngubani? $5 \times 1 = \text{----?}$

{What is 5 x 1 = ----?}

179. Learners: 5

Correct answer

26:00 180. Teacher: Ngu 5 siyevana? {It's 5, understood?} injalo into apha

sizo phinda siyiyenze nakwela cala naphayana sizothini?

{what ever we do one side we must also do on the other side as well}

Sizokuthi 3 over 5 simuthayimze naye ngobani?

{We will say 3/5 x ----?}

$$\text{Teacher: } \frac{3}{5} \times \frac{1000}{1}$$

181. Learners: Ngo 1000 over 1 {1000/1}

Answer was given already but the teacher asked again.

182. Teacher: Ngo 1000 over bani? {1000/ ----?}

183. Learners: Over 1 {1}

184. Teacher: Then sithini ke ngoku?

{Then what next?} Times numerator?

{multiply the numerator}

Izokuba ngubani ke ngoku izakuba phayana?

{What will be the answer?}

185. Learners: 3000
- Teacher: $\frac{3000}{5}$
186. Teacher: 3000 over 5 times 1 ibengu 5 siyevana? Then ke ngoku nantsiya pha ianswer yakho sizokwazi ke ngoku ukuyi simplifier sibhale ibe yifraction. {here is your answer, now we can simplify it and also write it in Fractional form} Sizoyi simplifier ke ngoku ifraction yethu phaya nê?
- Teacher's incorrect statement.
 $\frac{3000}{5} \times 1 = 5$
- {Then we simplify our fraction} so which is o 5 bayakwazi ukungena pha ku 5000 nê? B {5 goes to 5000} masiyi simplifaye, bangaphi oo5 phayana ku 5? {Let us simplify, how many 5s are there in 5?}
187. Learner: uyi 1 {just 1}
188. Teacher: uyi 1 then oo 5 phayana ku 20 {1 but how many 5 are there in 20 or 5 goes how many times to 20} Bangaphi? {How many 5's?} Ku 20? {in 20?}
- Teacher writes while questioning and responding to learner responses:
 $\frac{2000}{5} = \frac{400}{1}$
189. Learner: Bayi 4 {there are 4}
190. Teacher: Bayi 4 then sibeke oo zero nê? {4 then add zeroes} 5 divide by 2000 izakunika bani? 400
- Ere committed, teacher says: 5 divided by 2000
 $ei \rightarrow 5/2000$ incorrect
Should be $2000/5 = 400$
191. Learners: 400
192. Teacher: 400 over? {400/ ----?}
193. Learners: 1
- 27:00 194. Teacher: u400 over 1 usinika bani? {What is 400/1---?} Usinika u 400 anditsho? {Answer is 400 right?} Yi whole number le? {400 is a whole number, okay?}
195. Learners: Yes
196. Teacher: Size ngaphayana sidivide oo5 bangaphi ku 5? {On the other side 5 goes how many times to 5?}
- Teacher now refers to other component of ratio and writes: across #195 – 201:
 $\frac{3000}{8} \frac{600}{1} = 600$
197. Learners: 1
198. Teacher: Uyi 1 phayana u5, pha ku 30?

{It's 1 but how many in to 30?}

199. Learner: 6

200. Teacher: Bayi 6 ibengo zero bethu pa.

{They are 6 and then we put our zeroes to get 600}

600 over 1 simbhale as ubani?

600/1

{600/1 can be written as----?}

201. Learners: 600

202. Teacher: 600 siyevana? {600, are we together?} So ke ngoku kula

Teacher asked learners:

part ka 1000 ubunobona nê? {What can be seen in the case of

400 + 600 = -----?

1000?} anditsho u 400 plus 600 uzokunika bani? {400 + 600 = ----?}

203. Learners: 1000

Correct response

204. Teacher: u1000 because kuthiwa phayana kunumber la ratio kufuneka ikunike bani?

Learners were expected to finish up most of the sentences

{Number in a ratio should give an answer like ----?}

205. Learner: 1

206. Teacher: u1000 kuba kuthiwa la number pha la ratio yethu funeka

ukunike bani? {1000 in a ratio suppose to give you what---- ?} La 1000

nê? {1000} bangaphi pha xa usa la part la 2 into 3 kubani?

←The language does not give meaning here.

{How many are there if you take 2 as well as 3?} Ku 1000?

{In 1000?} So la 2 phayana izakuba ngubani?

What will be 2?} Ngu400 siyevana? Answer is 400, understood?}

Unless sum was written for reference.

So it's 400 into 600 siyevana? So ipart yakhe u 2 phayana ngubani?

{what should be the effect of 2} Ngu 400 then u3 yena ngubani?

{It is 400 then what is 3?}

207. Learners: 600

208. Teacher: Xa uzidibanisa eza zinto zikunika bani?

{If you add them together, what will be your answer? 1000 ikhona into

The teacher was gaining emotions because learners could not respond to her teaching.

enzima pha? {Answer is 1000, is there any thing that is difficult?}

209. Learners: No miss

210. Teacher: Ayikho mos into enzima? {nothing difficult here}

Ungayi traya because I example ndikunikile pha wenze u-B uyabona

U-B kuthiweni phayana?

{You can try it out B because I have given you an example,

28:00

28:40

do you
 have a clue for B?
 Kuthiwa 600 is a ratio of 2 into 3 uzoqale {600 is a ratio of
 2 : 3}
 uyibhale pha into fraction {write into fraction} then ke
 ngoku uyise
 phayana..... uyise pha kula 600.
 {then take it to 600}

*600 is a ratio of 2:3 →needs
 attention*

A pause – while learners prepare books for doing the
 example; teacher waits; then continues:

Mamela ke usenokuqala ngala ngeza rational numbers
 {listen you can start with rational numbers}
 uexperiencer nje ukuba kwenzeka ntoni {you become
 certain}
 then wenze le usandoyiva anditsho,
 {then do the recent one}
 nantsiya iexample ebhodini.
 {there, is an example on the board}
 Uzoqala ukuphele iexample?
 {Are you going to write or copy example first?}

211. Learners: Yes

29:00

212. Teacher: If ukhuphela iexample yikhuphele ngohlobo eback
 of
 encwadini yakho then uzoqala umsebenzi efront.

30:00

30:25

{Write example at the back of your work book and then your
 class
 work in front.}

*Learners are doing some
 “classwork” now;*

31:31

Teacher: let me write examples on the board

*(she show the learners on the
 board)*

exercise

Divide 1000 in the ratio of 2: 3

(a) $\frac{2}{5} : \frac{3}{5}$

→(she asked the learners

$= \frac{2}{5} \times 1000$

How do we multiply a number with a fraction?)

$\frac{2}{5} \times \frac{1000}{1}$ we say

*Teacher makes this sort of
 interrupting comments, and lesson
 ends this way.*

$= \frac{2000}{5}$

*(she moved around checking
 whether learners are doing the*

$= 400 \rightarrow$ answer

Also similarly:

$$\frac{3}{5} \times 1000$$

$$= \frac{3000}{5}$$

$$= 600 \rightarrow \text{answer}$$

Another pause from teacher as learners prepare to do some work

HOMEWORK

Find cube root of

1. $\sqrt[3]{9}$

2. $\sqrt[3]{27}$

3. $\sqrt[3]{28}$

LEARNER'S WORK

1. $\sqrt[3]{9} = 9$

2. $\sqrt[3]{27} = 15,58845727 = 15,59$

3. $\sqrt[3]{28} = 15,87450727 = 15,87$

So abantu abaninzi abanazo icalculator mos so why don't you start

leyana ine ratio's because aninazo icalculators to write eza zinto.

{Many learners don't have calculators but why are you starting the

one with ratio then?}

Mamelani {listen}if ni uyabhala pha, nenza la exercise lendithe jonga

la square root of 1 look to $\sqrt{1}$ }

leyana eza 5 into oyiyenzayo pha

yibhale ianswer yakho yonke before uyi.....

{write your answer complete before }

siyevana? {Understood?}

uyibhale yonke ianswer yakho eza numbers uzifumana pha

{write your answer in full} then uzise ku 2 decimal places uqale ngale

ye ratio's.

{Convert it to 2 decimal places} sebegqibile abanye?

{Have you finished?} Seniyigqibile le yeratios?

{Are you done with the ratio?}

work or not and she was surprise to find out that some learners don't have calculators)

(The learners work was not marked, they end up not knowing whether they were right or wrong. The lesson then ended here).

(she moved around checking whether learners are doing the work or not and she was surprise to find out that some learners don't have calculator)

Pause. Teacher not sure what she is saying

-----{cannot make out the word}

[School P3 Lesson 2]

Time	#	Speech	Notes and comments
00:00	1	<p>Teacher started her lesson on ratio's for the day. (The teacher wrote the definition of a ratio on the board as well as the method of dividing quantities in a given ratio + the examples as shown below)</p> <p>Teacher: Ratio: is the comparison of two numbers or quantities of the same →</p> <p>eg →</p> <p style="padding-left: 40px;">Dividing quantities in a given ratio.</p> <p>Method: Add up 2 values of the ratio and divide the total quantities by that a.... this gives a basic factor / fraction with which to multiply each value.</p> <p>Example: Two friends, Bob and Ben shared the money they earned from cleaning cars in the ratio 2: 3. They earn the total amount of R35. How much each got?</p>	<p><i>Teacher wrote the definition of the ratio, method and example on the board on the</i></p> <p><i>Teacher explains how ratio works</i></p> <p>2:3</p> <p><i>Teacher wanted the learners to work out how much each got from deferent hours they worked</i></p>
01:00	2	<p>Teacher + Learner: R35 was the total</p> <p style="padding-left: 40px;">Bob : Ben = 2 : 3</p> <p style="padding-left: 40px;">Total ratio: 2 + 3 = 5</p> <p style="padding-left: 80px;">↑</p> <p style="padding-left: 40px;">(Common era → was made)</p> <p style="padding-left: 40px;">2 + 3 = 5</p> <p style="padding-left: 40px;">(equivalent to R35)</p>	<p>Teacher together with learners could not notice the mistake they made.</p> <p>(Common era → incorrect operation)</p> <p><i>Teacher wrote:</i></p> <p style="padding-left: 40px;">Total ratio: 2 + 3 = 5</p> <p style="padding-left: 40px;">(this should be)</p> <p style="text-align: center;">↓</p> <p style="padding-left: 40px;">2 + 3 = 5</p>
	3	<p>Teacher: Divide R35 by 5 to get a basic factor → R7 or ($\frac{1}{5}$ of 35) {Okay?}</p>	
	4	<p>Learners: Yes, miss.</p>	
02:00	5	<p>Teacher: Bob + Ben got R35 out of the service they offered of cleaning the cars. They decided not to share the money equally.</p> <p style="padding-left: 40px;">From R35 → Bob got 2 parts of the R35</p> <p style="padding-left: 80px;">Ben got 3 parts of the R35</p>	<p><i>Statement said by the teacher</i></p> <p style="text-align: right;">← <i>She wrote on the board</i></p>
	6		

Ratio of Bob to Ben is: $\rightarrow 2 : 3$

Now we need to add the ratio ($2 + 3 = 5$)

Take the ratio and divide by 5 and multiply by 35

35 eg: $\rightarrow \frac{2}{5} \times$

\leftarrow The teacher could not explain the operation correct:

should

Take each part of the ratio, divide by 5 and multiply by 35.

eg: $\rightarrow \frac{2}{5} \times 35$

(a) Bob got $\frac{2}{5}$ of R35 $\rightarrow 2 \times 7 = R14$

Ben got $\frac{3}{5}$ of R35 $\rightarrow 3 \times 7 = R21$

{Abafumananga ngokulinganayo kuba omnye ufumene R14, omnye R21}

They did not get equal amounts because the other one got R14 and the other one got R21.

Cannot make sense of what the teacher is saying

Writes on the chalkboard

$\frac{3}{5} \times 35$

(b) Let us look to the following scenario.

Masijonge kule

Divide 600 in the ratio 3 : 2

1st write total ratio $\rightarrow 3 + 2 = 5$

We will write ratio against total

$\frac{3}{5}$ of 600 = $\frac{2}{5}$ of 600

We can find it also by using basic factor.

{Siqala siyenze kanjena, niyaqonda?}

{We first do it like this. Do you understand?}

7 Learners: {hauled/made noise}

Sign of dissatisfaction

06.00 8

Teacher: Is it going to confuse you?

9 Learners: Yes

They responded

07.00 10

Teacher: Okay, let us follow the method above. Let us show them all.

She said

eg \rightarrow Next step $\frac{3}{5} \times 600$

= $\frac{1800}{5}$

= $\frac{360}{5} \rightarrow$ answer

\leftarrow Teacher's writing on the board

Similarly: $\frac{2}{5} \times 600$

= $\frac{1200}{5}$

= $\frac{240}{5} \rightarrow$ answer

08.00

If you add $360 + 240 = 600$
Can I give you other examples?

Teacher ask learners

11 Learners: Others say yes, and others say no, We don't understand all these.

One boy was heard saying it forcefully.

[One could hear that the class did not understand what the teacher was asking.]

09.00 12 Teacher: How many of you got it correct?

13 Learners: (Signalled by the show of hands)

10.00 Teacher: 120 ratio of 3 : 4 : 5

The teacher wrote on the board

14 Total ratio $\rightarrow 3 + 4 + 5 = 12$

$$\begin{array}{ccc} 3/2 \text{ of } 120 & 4/2 \text{ of } 120 & 5/2 \\ & & \text{of } 120 \end{array}$$

Are you not going to manage to calculate from this step above?

15 Learners: We will manage.

Learners responded out of concern

11.00 16 Teacher: How are we going to continuous?

$$\begin{array}{ccc} = & \underline{360} & \underline{480} \\ \underline{600} & & \\ 12 & 12 & 12 \\ \\ = & \mathbf{30} \rightarrow & = \mathbf{40} \rightarrow \\ = \mathbf{50} \rightarrow \text{answers} & & \end{array}$$

She interrupted learners by writing on the board before they answer the question.

Check by adding numbers above.

$$30 + 40 + 50 = \mathbf{120} \rightarrow \text{answer}$$

Can I give you more?

Teacher added answers and sum up to 120

17 Learners: No

There is some confusion and mumbling in the class

12.00

18 Teacher: *(Wrote class work on the board)*

She commented with a command

13.00

19 LEARNER'S WORK

(a) Divide 133 to ratio 3: 4 between Peter and Pinky

$$3 + 4 = 7$$

$$3/7 \times 133$$

$$\frac{300}{7}$$

$$\mathbf{57} \rightarrow \text{answer}$$

← One learner's work book was shown on the video with the following work out sums.

Teacher assists one learner who is surely struggling with the concept

$$\text{And } 3 + 4 = 7$$

$$\begin{aligned} & \frac{4}{7} \times 133 \\ = & \frac{530}{7} \\ = & \mathbf{76 \rightarrow \text{answer}} \end{aligned}$$

20

(b) Divide 28 sweets to ratio 1 : 2 : 4

Learner's work

$$\begin{aligned} 1 + 2 + 4 &= 7 \\ \frac{1}{7} \times 28 & \\ &= \frac{28}{7} \\ &= \mathbf{4 \rightarrow \text{answer}} \end{aligned}$$

And also

$$\begin{aligned} 1 + 2 + 4 &= 7 \\ \frac{2}{7} \times 28 & \\ &= \frac{56}{7} \\ &= \mathbf{8 \rightarrow \text{answer}} \end{aligned}$$

and

$$\begin{aligned} \frac{4}{7} \times 28 & \\ = \frac{112}{7} & \\ = \mathbf{16 \rightarrow \text{answer}} & \end{aligned}$$

18.00

CLASSWORK

21
19.00
20.00
22.00

1. Divide 133 apples between Peter and Pinky in a ratio 3: 4
2. Divide 28 sweets in to the ratio 1: 2 : 4
3. Anele and Jane are harvesting potatoes for every 3 bags, Anele harvest, Jane harvest 5 bags.

(She went to one learner who was not getting along with the others, repeatedly pronouncing the method and showing the how part on his book).

220

Andazi ukuba nithetha ntoni, kumele ukuba niyabala.

[I don't know what are you talking about, you should be writing]

she said this in between, before she could finish writing the sentence.

23.06

Together they harvest 104 bags. How many does each harvest?

Teacher: Is there any one who is done with number 1 (one)?

(she was heard in between saying:)

“ forget about the calculator, show/tell me what to do”

22 Learners: {the learner's response was not picked up by the video}

23.39 23 Teacher: (she was moving around checking learner's work)

The lesson ended up when the teacher was doing an individual attention trying to pull out those who were left behind in understanding today's lesson

University of Cape Town

[School P3 Lesson 3]

Time	#	Speech	Notes and comments
00.00	1	Learner: A male learner does an exercise on the board for the class	Some learners are not interested in what is happening
		$\frac{3}{7} \times 133 = \frac{399}{7}$ $= 57$	
		$\frac{4}{7} \times 133 = \frac{532}{7}$ $= 76$	
	2	Learner no 1: Iright le answer? {Is this answer right?}	
	3	Learners: Yes	
01.45	4	Teacher: {Ngubani omnye ozakwenza enye isum ebhodini?} {Who else is going to do the sum on the board?}	
03.29	5	Learner no 2: Writes slowly on the board $\frac{2}{7} \times 28 = \frac{56}{7}$ $16 + 4 + 5$ Later he writes $16 + 4 + 8$	Learner seems unsure of what he is doing. The teacher is not saying anything
4.00		$= 28 \longrightarrow$	
05.51	46	Learners: Mumbling and noise in the classroom	
06.55	7	Learner no 3 writes on the board $104 = 3 + 5 = 8$ $\frac{3}{8} \times 104/1 = 5/8 \times 104$ $312/8 = 39/1 + 520/8 = 65$ $39 + 65 = 104$	
08.21	8	Teacher: Mamela ke, wonke umntu uyifumene la answer phaya? {Listen; did everybody get that sum right?}	Teacher goes around the class checking learners work
09.24	9	Learners: Yes	
	10	Ngubani ongayifumananga? {Who did not get it, who did not get it?} Teacher goes around checking learner's work	
10.00	11	Teacher: Class work {Ngobani aba bangxolayo? Ndine worry kuba ukhe ndababona} {Who is making noise? I'm worried them if I find them}	The class is noisy
		Learners are working on their class work	
11.42	12	Teacher: {Mamelani: Nimbonile u question 1 abantu	

bangathi khang bambone}

{Did you see question 1? Please do not say you did not see it}

Khetha kula list yakho u(a) ubhale zonke ezi zi rational numbers ku (b) zonke ezi zi irrational

{Choose from the list (a) and write down all rational numbers from (b) all the irrational numbers

13	Learners: Yes	
14.18	14 Learners are still working on their class work	Teacher is going around assisting some learners
16.23	15 Learners are still working on their classwork	The class is noisy
18.45	End of lesson	

University of Cape Town

[School P6 Lesson 1]

Time	#	Speech	Notes and comments
00:00	1.	Teacher: Okokuqala phaya { firstly there} we've got a to the power zero, we want to see ukubana {that} a to the power zero uzakuphela esinika ntoni na {what will the answer be?} right?!	
	2.	Learners: Yes	
	3.	Teacher: As we are dealing with exponents we did law one of the exponents, apho besisithi { whereby we said} if you multiply power of the same base, what do we do kanene? {again?}	
	4.	Learners: You leave the base as it is	
	5.	Teacher: For instance lets say we a to the power two times a to the power three $a^2 \cdot a^3$ what do you say we going to do?	
	6.	Learners: Responding but cannot make sense.	
	7.	Teacher: Ok! We put the exponents...the base as it is nhe? {right?}	
	8.	Learners: Yes	
	9.	Teacher: Than? You add two plus three andithi? {is it not?}	
	10.	Learners: Yes	
	11.	Teacher: Equals to?	
	12.	Learners: a to the power of five.	
	13.	Teacher: Here we still multiplying powers of the same base nhe? {right?}	
	14.	Learners: Yes	
	15.	Teacher: Ok! What are we going to do?	
	16.	Learners: a to the power three plus open brackets negative three. $a^{3+(-3)}$	
	17.	Teacher: Ok! We write that number in brackets because its number is negative, and then?	
	18.	Learners: Equals a to the power three	
	19.	Teacher: And than we will work out this, plus times a negative?	
	20.	Learners: Negative three	
	21.	Teacher: So it means this a to the power zero siye sibe naye xa besi-multipliyisha ii-powers {we had it when we multiplied the powers} whose exponents are equal but with different signs andithi? {right?}	
	22.	Learners: Yes	
	23.	Teacher: this is from law one that is multiplication of powers within the same bases andithi? {right?}	
	24.	Learners: Yes	
	25.	Teacher: Lets say we have this, a to the power four divide by a to the power four, this time we are dividing than what do we do?	
	26.	Learners: a to the power four	
	27.	Teacher: a to the power four times?	

28. Learners: minus
29. Teacher: This boy is telling us if we are dividing we have to subtract, ok! unyanisile? {is he correct?} We are not going to multiply we are going to subtract, so what are you going to subtract?
30. Learners: four minus four
31. Teacher: Is equal to?
32. Learners: a to the power zero
33. Teacher: but asikamboni ukuba this a to the power of zero ulingana nabani na andithi? {but we have not seen that this a to the power of zero is equal to what?}
34. Learners: Yes
35. Teacher: Ok lets do it in another way, a to the power four, if we are expanding iba ngubani? {what will the answer be?}
36. Learners: $a \times a \times a \times a$ divide by $a \times a \times a \times a$
37. Teacher: Ok! What do we see in our numerator and denominator? So a uyakangaphi apha? { a goes into here how many times?}
38. Learners: one, one, one...
39. Teacher: So what are we left with?
40. Learners: One
41. Teacher: Kwi-numerator {at our numerator} we are left with?
42. T&L: one times one times one times one
43. Teacher: Equals to?
44. Learners: one
45. Teacher: and then at the denominator we are left with?
46. Learners: one times one times one times one times one
47. Teacher: Is equal to?
48. Learners: one
49. Teacher: So one over one is equal to?
50. Learners: One
51. Teacher: what do you notice here? We have a divided by four equal to?
52. Learners: one
53. Teacher: Xa sisebenzisa {when we are using} this method of expanding our powers andithi? {right?}
54. Learners: Yes
55. Teacher: Yes but if sisebenzisa {we use} that law, the second law ze-exponents zethu {of our exponents} sifumana {we get} a divided by a is equal to a to the power zero than what can you say?
56. Learners: Saying something but cannot make sense.
57. Teacher: Ok! a to the power zero is equal to?

58. Learners: One
59. Teacher: I think we all know that when we are dividing any number by itself, we get?
60. Learners: one
61. Teacher: Andithi? {is it not?}
62. Learners: Yes
63. Teacher: It means lo nto { that} two divide by two equals to two to the power zero. So this two to the power zero is the same as?
64. Learners: one
65. Teacher: and we know that if there is no exponents we know that it is one, so we apply the second law of the exponents that when we are dividing the powers of the same base we subtract the exponents, one minus one is equal to?
66. Learners: two to the power zero
67. Teacher: is equal to?
68. Learners: one
69. Teacher: So any power with the exponent zero is equal to?
70. Learners: one
71. Teacher: What is the answer to this one, ten to the power zero? Ten to the power zero?
72. Learners: one
73. Teacher: Ten to the power zero is one, and what about $(2x)$ to the power zero?
74. Learners: one x
75. Teacher: Is equal to one. (abc) to the power zero?
76. Learners: One
77. Teacher: Is equal to?
78. Learners: one
79. Teacher: If you say two-hundred to the power zero, the answer is going to be?
80. Learners: one
81. Teacher: Sijonge kengoku xa sine-negative exponent { lets look at when we have a negative exponent} most of the time we do not like to give our answers with negative exponents nhe? {right?} For instance maybe we have two to the power minus one, and the question says write the power without a negative exponents, how are we going to write it?
82. Learners: Saying something but cannot make sense of it.
83. Teacher: Ok! we change that power and write it as a fraction, but i-fraction ke ayizusuka kude, asizuthatha { the fraction wont be taken afar and we wont take it} from other numbers from outside, amanani siwasebenzisa { we use the numbers} from here, siyavana? {do we understand each other?}
84. Learners: Yes Miss {teacher}

85. Teacher: We got only one power apha {here} andithi? { is it not?}
86. Learners: Yes
87. Teacher: Singaphi ii-powers apha? { how many powers that are here?}
88. Learners: one
89. Teacher: Do we have any number that is written in front of this number?
90. Learners: No
91. Teacher: And if we don't have a number we take that the number that is there is equal to?
92. Learners: one
93. Teacher: The number that is here is equal to one, so we've got one of this power, so if its one of.... Its like one times its power andithi? { is it not?}
94. Learners: Yes
95. Teacher: So we are going to change its power to a fraction, sizakuyitshintsha kanjani? { how are we going to change it?} Sonke mos siyayazi ukuba i-fraction { we all know that a fraction has got a numerator and a denominator but now how are we going to write that fraction?}
96. Learners: Saying something but cannot make sense of it
97. Teacher: Ok! the answer is going to be one over two to the power one, do we all Agree?
98. Learners: Yes
99. Teacher: Others say yes, others say no. Ok! I agree that the answer is one over two, but izakanjani lo nto? { how does that come about?}
100. Learners: Saying something but cannot make sense of it.
101. Teacher: How many powers are here?
102. T&L: Its one
103. Teacher: So this one will be? The numerator andithi? { is it not?}... change this negative to the exponent, and again she's telling us an exponent that is equal to one asizokuyi bhala { we don't usually write it} so the answer to this is equal to one over two siyavana? { do we understand each other?} Ok! who can tell me an answer to this one four to the power negative one?
104. Learners: one over four
105. Teacher: would be?
106. Learners: one over four
107. Teacher: I want that without a negative exponent, how are we going to write the without a negative exponent? Hands up?
108. Learners: two over two x to the power three.
109. Teacher: Do we all agree?
110. Learners: No...yes

Learners seem to be not sure about the correct answer

111. Teacher: Then what about this one. a to the power negative one b to the power two c to the power negative three $a^{-1} b^2 c^{-3}$ what is it going to be without a negative exponent? Hands up?
112. Learners: b to the power two over a to the power three
113. Teacher: Before sisebenze ukhona umntu onombuzo? {Before we start working, anyone with a question?} Ukhona osele egqibile ayokusibonisa ebhodini? { is there anyone who has finished and go show us on the board?}
114. /Learner going to the board to do number thirteen/
115. Teacher: Do we all agree?
116. Learners: Yes
117. Teacher: Can you tell us how you got this one as an answer?
118. Learners: Saying something but cannot make sense.
119. Teacher: So any number with exponent zero is equal to one so which of the two numbers has got an exponent zero?
120. Learners: it's a...
121. Teacher: We've got five times a to the power zero or five a to the power zero?
122. Learners: Saying something but cannot make sense of it.
123. Teacher: Okokuqala {firstly} what are these two things, are they multiplying or are they dividing or are we adding or subtracting? What is happening here? When there is no sign in between, what is happening? We are?
124. Learners: Multiplying
125. Teacher: Ok! its only that one that gives us one andithi? {is it not?}
126. Learners: Yes
127. Teacher: this is what she has written two to the power negative three which equals to one over two to the power three. Is she right or wrong?
128. Learners: right...wrong
129. Teacher: Ok! the last one before sizenzele { we do it individually} Lets do number nine, who is going to do number nine for us?
130. /Learner going to the board to do number nine/
131. Teacher: Is this one correct?
132. Learners: Yes
133. Learners: I-wrongo { it is wrong}
134. Teacher: Ok! wonke umntu othi i-right makaphakamise isandla? {Everyone who agrees with the answer raise your hands up} the whole class, Ok!
135. Bell goes

31:18

End of a lesson

[School P6 Lesson 2]

Time	#	Speech	Notes and comments
01.26	1.	Teacher: Okay eemm... I just want to remind you guys what we were doing yesterday. Writes on the chalkboard.	
	2.	Teacher: Yesterday we were doing something on powers that have got negative exponents, nhe? we are aware of the classes. For instance, the 2 to the power negative 1. xa bendibuza ukuba {when I asked if} how do I write this without any exponent? They say, okay, this goes 1 over 2. Is that right or wrong?	
	3.	Learners: Right	
	4.	Teacher: Right, and when I asked them, how do you get this 1 over 2 they say okay, this one, this one.	
	5.	Learners: Yho!	
	6.	Teacher: and then this division sign is taken this and took this 2 and write it. Is that how it goes?	
	7.	Learners: No!	
	8.	Teacher: How do we get 1 over 2? From 2 to power negative 1. if you say no then how do you get 1 over 2 from power minus 1?/silence in the classroom/	
	9.	And if we were saying here that that student was right, what was going to be the answer for this? If you change this, you change this; I mean would this be 3 over 2?	
	10.	Learners: No!	
	11.		
	12.	Teacher: Can anyone of you, okay Kinana come and show us how we do, get 1 over 2 from this? Emveni kwakhe nguwe. {after him it's you} ingathi ngewucinga nawe. {you better start thinking}	
	13.	Learners: Yinto eyi one lena, {this is one thing} xa iyinto eyi oneit's co-efficient izakuba ngulo qha. {the co-efficient is only going to be this} So funeka {the must}... always ikhona inumber pha phambi kwayo. {there is always a number in front of it}. Inumber pha ngu 1. {the number there is one} So sizothini? {what are we going to do?} 1 times pha {there} ... so 1 times 2 ... ja, {yes} la X uba ngu divided {that X becomes divided} ... la {that} 1 times ... 1 is 1. 1 times lena kengoku izakusinika la 2. Ihe irth {this one is right}. I-exponent ka 1 mos ipositive so ayisebenzi lena {1's exponent is positive so this one is not working.} /Learner explains to the class, but inaudible/	
	14.		
	15.	Teacher: I think I am satisfied yila answer bethunana {people}. Ukhona omnye umntu ongayiqondiyo? {is there someone else who does not understand?} then what about lena {this one}? Hambo hlala phantsi {go sit down}, thank you. Uthi because xa kungekho nani {he says because there is no number} we know there's always {u}1. 1 as a co-efficient multiplying lo {this} power, that is niyiniweyo {given}. So simply change multiplication into division and take the whole number into denominator and change the negative exponent to the positive exponent.	
	16.	What about there? 2 to the power minus 3.	
	17.	Who wants to come and show us? That power when it is in calculative exponent.	
	18.	Who wants to answer? Who wants to come and try? Yes.	
	19.		
	20.	/Teacher walks to the back, learner writes the sum on the	

06.44

- chalkboard and explains to the class/
21. Learners: La {that} ... like this... faka u1 pha phambili sizothayimza ngayo {put 1 there in front so that we use it to times} u multiply sizomtshintsha abengu division {we change multiplication into division}, sithathe la 1 sibeke apha {we take that 1 and put it there}, sithathe le siyibeke pha kwi exponent {we take this and put it in the exponents}.
 - 22.
 23. Teacher: Okay, same way as ... let's say we have $A B$ power negative N right?, so how are we going to write this calculative exponent? The one that is affected by the negative exponent is this part right? So the co-efficient here is A . i answer here, what are we going to have? Hands up. Yes?
 24. Learner: A divided by B to the power N .
 25. Teacher: A divided by B in to the power N . and also did something like A to the power zero and any number is equals to?
 26. Learners: 1
 27. Teacher: Can anyone of you come and make umzekelo wakhe {their own example}? Apho azakufumana u {where they will get} A to the power zero meaning 1.
 28. /Silence, no one moves to the front. The same boy stands up and writes the sum while explaining to the class./
 29. Okanye ezinye {or any} any number to the power of zero tat gives us 1. Oh okay, thanks. Uzenzele owakho umzekelo {make your own example}.
 30. Learners: u A zero, ndiyenze kwalena? {must I do the same one?}
 - 31.
 32. Teacher: Ezinye {other} inumbers with exponent zero kodwa.
 33. Learner: A^4 divide ngo {by} A^4 . so kengoku {now} it's equals ukuba {if} A zero ... so lena siyibona ngoluhlobo {this is how we see this}. So u- A {solves the sum on the chalkboard silently} 1 times 1?
 34. Learners: 1
 35. Learners: 1 times 1?
 36. Learners: 1
 37. Learner: 1 times 1?
 38. Learners: 1
 39. Learners: 1 times 1?
 40. Learners: 1
 41. Teacher: Hmm... ewe {yes} that is his example. I don't think iexample yakho izofana neyomnye {thank you} {I do not think your example will be the same as anyone else's}. omnye {another one}. Okay thank you, thank you very much. Omnye? {another one} ... yena ukhethe ukwenza {he chose to do}... he is dividing A to the power of 4 by A to the power of 4 right? Wathi {he said} A divided ... A to the power of 4 by A to the power of 4 is equals to A to the power of zero okay wagqiba wathi {and then he said} 1 is equals to 1. Omnye umntu maybe uzofuna ukwazi ukuba la zero {some one will want to know about that zero}, besino 4 mos pha as an exponent andithi? {is that so?}
 - 42.
 43. Learners: Yes
 44. Teacher: Nalapha sino 4 times as an exponent.
 45. Learners: Yes
 46. Teacher: Ngoku sekutheni ngoku ianswer izoba no zero exponent? {why does the answer now suddenly has got a zero exponent?} maybe one of you unalo mbuzo unjalo {has got a question

like that}. Inoba la zero ebeqale wavela phi? {where does that zero come from?}

47. Learner: Xa udivider {when you divide} ... {very soft spoken I could not make out the rest of the words}

48. Teacher: Okay, uthi ikhona la law of exponents xa sidivayidisha ipowers {she says there is a law of exponent when you divide} ... emm... when we are dividing powers of the same value what do we do?

49. Learners: Subtract

50.

51. Teacher: Subtract andithi {is that so}? Now ndifuna sigqithe {I want us to continue}. Okay, omnye makazosenzela owakhe umzekelo {some one else must come make their own example}. Can anyone come and enze owakhe umzekelo {and make their own example?} where you are going to have a different base, engazukuba ngu A {that is not going to be A}.

52. Any base. ?

53. /Learner writes sum on the board silently and does not explain, she only includes the

54. rest of the class to get the answer/

55. Learner: 1 times 1 times 1, so u 1 times 1 uya kayi 1 {goes once}, kayi 1 {once}, kayi 1 {once}, kayi 1 {once}, kayi 1 {once}. 1 times 1 is 1. 1 times 1 is 1. 1 times 1 is 1. 1 times 1 is 1. 1 ibengu {then it is} 1. 1 times 1. 1 times 1. 1 times 1. 1 times 1. 1 times 1. 1 divide by 1 is 1.

56.

57. Teacher: Okay, {eem} can I please... any ... okay masenze nje {let's do like this}.

58.

/Teacher writes on the chalkboard/

59. What is that one going to be equal to? Uyabona {you see} this one is a combination of ... we have got power ... I mean pha {there} ... exponents zero and negative exponent. What is going to be the answer for that one? what is that one equals to? We want it without a negative exponent and again we want without zero exponent. What is going to be equal to? Okay khaniyitraye apha ezincwadini zenu leyana. {try it in your books}

16.35

60.

/Teacher walks around class checking if learners are doing the sum/

61. Teacher: Okay unfortunately ukhona endimbona egqhibile {I've seen some one who is finished}... anikagqhibi? {are you not finished?} Beningekaqali kwa kuqala {you havent even started}. Ndininike ichance? {should I give you a chance?} umzuzu ubeyi one. {one minute}?

62. Learners: Yes

63. Teacher: Okay, 1 more minute to finish up.

64. Teacher walks around explaining to learners individually.

65. Teacher: Lena ibinjeyana {this one was like this}, yintoni kengoku uyichanger? {why change it?} ... nantsiya {there it is} . Okay uright uyithathile pha wazoyibeka apha {he is right, he took it there and out it here}. Leya ibingafanelekanga ukuba {that one was not suppose to be} ... so lena apha kushiyeka {so this one here is left}... la {that}... u ... ukunika bani? {what does it give you?}

66. Learner: 1

67. Teacher: U1 ungena apha {one goes in here} ... {continues but cannot make sense of the words clearly} ngubani omnye? {what else?}
68. /Teacher explains to learners individually/
69. Teacher: Okay I'm coming. Ukhona umntu oyenzileyo? {is there some one who has done this?}
70. Learners: Yes
71. Teacher: Iphi? {where is it?} Ja! {yes} Ja! {yes} Uyayibona? {do you see it?} Ja! {yes} Ukhona okopisileyo apha qha andiyazi ngubani. {some one copied here but I'm not sure who it is} Ngubani omnye? {who else?} Okay ndicela umntu azosibonisa kengoku, {can I please have someone show us} okay.
72. Learner: Hayibo miss {no miss}
73. Teacher: Hamba {go}
74. Learners: Hamba mani {just go}.
75. /Learner writes sum on the board but does not explain to others/
76. Learner: Asi understandi {we do not understand}
77. Learner: Umfumane njani la 3? {how did you get that 3?} Cacisa kaloku. {explain}
78. Teacher: Niyayazi kaloku asifani, {you know we are not all the same} some of us are shy, some of us are not shy. Some of us can speak in front of others, some of us cannot. Who can come and tell us ... first of all is this correct or not correct?
79. Learners: Correct
80. Teacher: If it is correct, how is it correct? For instance mna {I} I'm in grade 9 I do not know where this one ... I just want to know where that one comes from and again teacher has given us A minus 2, but now the class agrees that the answer is 1 over A to the power 2 this there. Whereas this A wasn't ... I am not sure, I mean I am confused I don't know what's going on. Okay ngubani ozondixelela? {who will tell to me?} Okay akukho ufuna ukundixelela. {there's no one who wants to tell me}
81. /The same learner explains to the class how they got the answer/
82. Learner: Uyabona la {do you see that} A negative power 2? Siyihlise siyibhale ezantsi ibeyilantuka {we move it down and it becomes the...} ibeyi {it becomes the...} denominator la {that} 3. B to power 3 siyamyeka yena {we leave it} so uC... 1 power xa {when} ... 1 base xa ine {when it has} zero power ibangu {it becomes} 1 so kengoku la {now that} 1 uphuma pha ke. {comes from here}
83. Teacher: u-1 usuka kula {comes from that} C to the power zero.
84. Learners: Yes
85. Teacher: Okay, this one is from here.
86. Learners: Yes
87. Teacher: and then this one because this is the only power that is being affected by the negative sign or that has got a negative sign. So the only thing that we have to remove from here to here. Okay masenzi enye before ke ngoku... {let's do another one before...}
88. /Learners start having conversations on the side/
89. Teacher: Quickly, ndizokhe ndibone ke ngoku ngubani ozakuyifumana engakhange a-assist we because ni assist iwe nonke nina.
90. /Learners attempt to answer the sum quietly and without any assistance, while the teacher walks around and marks learners. Learners start having conversations about who got the sum

32.06

- right or wrong/
91. Teacher: Ndifuna umntu ozakuyifumana engakhange encedwe. {I want some one who will get this without being helped} Ehm... uyababonisa nhe? {you showing them the answer?}
92. Learner: Hayi miss {no miss}
93. Teacher: Andiyazi ukuba aba A 1, {I'm not sure where you get this A1} bavelaphi,aba A 1? {where do you get this A 1?} Okay Okay.... Phaya {there}. Straight away which one is going where? Which one? Moving from this position. Andithi? {is that so?}
94. Learners: Yes
95. Teacher: this one is equals to ?
96. Learners: 1
97. Teacher: u-1 kanene nizombhala as? {you will write 1 as?}
98. Learners: No!
99. Teacher: So what are you going to be left as numerator?
100. Learners: A ... AB
101. Teacher: My answer is A over? B. bakhona ke endiba korekishileyo abano {there are some people I marked correct who had} A times 1. andiyazi la times 1 bamthatha phi {{I don't know where they get the times 1} but ndifane ndabakorekisha {I gave them the answer} but ke so far umntu ode wandinika ianswer yam enje { the only person who has given me the right answer} ... engena {without} ... engena nto {without anything} ... ngu {it's} Kinana.
102. Learners: Yho! {make a noise}
103. Teacher: Okay, today ndifuna kengoku sijongeni ukuba {I want us to look at} what if now ewe {yes} have something like, it's an A ... this is A times B all raise to bani? {what?} to N
104. Learners: N
105. Learner: Siyiyenze encwadini miss? {must we do this in our books?}
106. Teacher: No, andiqondi ukuba besisesiyiyenzile. {I don't think we have done this before} What are we going to do? Or are we going to work out this? Okay okokuqala {firstly} inside here we've got ... okay we've got A times B. we've got a product of A times?
107. Learners: B
108. Teacher: So phaya {there}, each and every fact epha ngaphakathi {that is inside there} is going to have that exponent siyevana? {do we understand each other?}
109. Learners: Yes
110. Teacher: So we are going to have A to the power N times B power N siyevana? {do we understand each other?}
111. Learners: Yes
112. Teacher: If it was ... A squared, B cubed all raised to N. ibizothini kanene? { what was it going to be again?} Ibizothini? {what is going to be?} Thetha kaloku lento uyithethileyo {say what you have just said}
113. Learner: A power N
114. Teacher: A power N and then?
115. Learner: {says something but cannot make out what it is}
116. Teacher: Okay this exponent is going to multiply other exponents siyevana? {do we understand each other?}
117. Learners: Yes
118. Teacher: This exponent, one outside brackets is going to multiply other? Exponents
119. Learners: Exponents
120. Teacher: Okay phaya iexponents zalapha bezingubani kanene?

39.33

- {what were the exponents here?} Ibingo 1 andithi? {it was 1. Is that so?}
121. Learner: Yes
122. Teacher: So what is one times N?
123. Learners: N
124. Teacher: One times N is equals to?
125. Learners: No
126. Teacher: So this time what are we going to have? We are going to have A to the power 2 multiply by N
127. Learners: N
128. Teacher: The B to the power?
129. Learners: 3
130. Teacher: Multiply by?
131. Learners: N
132. Teacher: Then ibengubani? {what is it going to be?}
133. Learners: A
134. Teacher: ehm... to the power?
135. Learners: N
136. Teacher: B to the power?
137. Learners: 3N
138. Teacher: Siyevana? {do we understand each other?}
139. Learners: Yes
140. Teacher: Let's say is 2, asifake amanani. {let's use numbers} 2 squared times 3 all raise to 2. naphaya {there} we are going to say?
141. Together: 2 to the power 2 times 2
142. Teacher: andithi? {isn't that so?}
143. Learners: Yes
144. Teacher: times?
145. Learners: times 3 power 1 times 2 equals
146. Teacher: Equals to? 2 squared... I'm sorry power?
147. Learners: 4
148. Teacher: times?
149. /Teacher writes on chalkboard while learners are talking/
150. Learners: 3 squared
151. Teacher: 3 squared nhe?
152. Learners: Yes
153. Teacher: Now siyamazi {we know} u 2 to 4 ukuba ngu {that it is} 16 nhe? {right?}
154. Learners: Yes
155. Teacher: 16 times?
156. Learner: Ngu {it is} 40
157. Learners: 9
158. Teacher: You can give an answer to that. Wonke umntu une calculator yakhe {every one has got their own calculators}. Abayi 10 O 16 ngu 160. { 10 16'S equal to 160} minus 9 ibengubani? {it becomes?}
159. Learner: Ibengu {it becomes}
160. Teacher: 1?... 150? ...
161. Learner: 151
162. Learners engage in conversations while teacher writes on the board.
163. Teacher: Okay masijongeni phayana. {let's look there?} They want to simplify 2 A tubed, B squared all raised to?
164. Learners: 3
165. Teacher: it is going to be?
166. Learners: 2 A ... 2 A times

167. Teacher: Okanye mandinike umntu oyi 1 {I must give one person}...okay
168. Learner: equals to miss... 2 times
169. Teacher: Ujonga ianswer? {are you looking at the answer?}
170. Learner: No miss
171. Teacher: Okay, bendithe kaloku {I said} this exponent is going to multiply other exponents ezinga phakathi. {that are inside} So masiqaleni phaya. {let's start there}
172. Learners: 2
173. Teacher: iexponent yalapha ngubani? {what is the exponent here?}
174. Learners: ngu 1 {it's 1}. times 3. A times 3, B times 2 times 3
175. Teacher: Then?
176. Learner: 2 to the power 3
177. Teacher: Then?
178. Learner: A times
179. Teacher: 3 times 3 is?
180. Learners: 9
181. Teacher: Then?
182. Learners: 3 power 6
183. Teacher: Okay what is tubed?
184. Learners: 8
185. Teacher: Then? A
186. Learners: A power 9, B power 6
187. Teacher: Okay, I understand. Yesterday I gave you some paper like this where there were examples, that is why you are all singing. Now I just want to see if you are going to sing again.
188. Learners: Yes
189. Teacher: Nanku uexercise {here is the exercise} 2 point 7. we are going to select some
190. Learners: Yes
191. Teacher: I want us to do number ...
192. Learners: 1 ... 2
193. Teacher: Let's try number 1 ... okay number 1, number 2, number 3. let's all try number 1, number 2, number 3. our classwork. Khangela u number {look at number} ... exercise 2 point 7.
194. Learners again start conversating in the background then they silently do the classwork while the teacher is walking around checking on learners work.
195. Teacher: Have we finished?
196. Learners: No
197. /Teacher continues walking marking and helping learners with the classwork/
198. Teacher: Ha ah... stop this.
199. {talking to a learner}
200. Teacher: This is number 2 kaloku ndithe yenza 1.2 and 3 {I said do number 1 2 and 3}
201. {to another learner}
202. Teacher: Iright because awumazi u X ulingana nabani, {it's right because you do not know how much X equals}} no Y ulingana nabani {and how much Y equal to}. But atleast this one even here u 2 squared uyamazi ngubani nhe? {you know 2 squared right?}
203. Learner: {nods his head}
204. {to another student}
205. Teacher: I want to see ukuba lo 1 umfumene kanjani? {how you got this 1} Ndibonise lo 1 {show me this 1} ... squared is only times

- 2, A times by squared is multiplied by 2.
206. Learner start making a noise
- 207.
208. Teacher: Shhhhh ngubani othethayo kengoku? {who is making noise now?} Makaphume phandle ukuba ufuna ukuthetha. {he/she must go outside if he/she wants to talk}
209. /Teacher talking to a learner/
210. Teacher: Okay listen, this one is correct nhe? then what is 3 times 4? ... 3 times 4 asingo... {is not} 16, yibhale {write it}. So le ndawo {this place}... ubu right nantsi i answer {you were right here is the answer}. Masijonge le yokugqibela. {let's look at the last one} Wena? {and you?} Okay, hmmm ... this one, ibiyile {went}. Then this 3 times 4? Oo 3 xa beyi 4 benza bani? {3 times 4 make what?}
211. /Class becomes noisy/
212. Teacher: Hey! Hey! Hey! Hey! Hey!
213. Learner: Shhhhhhhh!
214. Teacher: Hmmm, 2 comma 4 is? 2 times 2 times 2 times 2 right? and is different from the times 4 but 2 power 4 is 2 times 2 ...
215. {To another learner}
216. Teacher: But this one to the power 4 in not 2 times 4. it's 2 times 2 times 2 times 2. okay ukhona umntu ofumene 3 out of 3? {is the anyone who got 3 times 3?}
217. Learners: Yes
218. Teacher: Okay omnye makazokwenza unumber 1 {some one must come do number 1}. shhhh masingangxholini kukho abantu ababhala ebhodini. {let's not make a noise when there are people on the board}
219. Learners continue making a noise
220. Teacher: Okay, okay, okay ... number 1, ngubani obhale u number 1? {who did number 1?} If you are making a noise, infact nizokuya ebreakini xa nithulile nonke, as long as nisathetha. {you will go on break when you are all quiet, as long as you are talking} Ahhh okay for number 1, the answer is A to the power 9 times B power 6. bangaphi abayifumeneyo? {how many got the answer?} Blacks blacks blacks blacks {addressing a learner}...
221. Learners: {Laugh}
222. /Teacher goes around the class marking learners books/
223. Teacher: Ubuyifumene manyani? {did you really get it right?}
224. Learner: Yes miss
225. Teacher: Are you sure?
226. Learner: Yes miss
227. Teacher: Then for number 2, where is number 2? Okay number 2 bakhona endibaziyo ukubana khange bayi {there are people I know who did not} ... okay 16 times power 8 times Y to power 12. hands up kubayi fumeneyo {to those who did it?}. Ukhona endimbonayo aphakamisa isandla kodwa akayifumenanga. {I see some one who has their hand up but I know they did not get it right} Then kule {this one}... shhh... Onke wenze ngolu hlobo {Onke you did it like this}. Masijongeni leya {let's look at that one}. U Onke wenze le yana ebengakayigqibi {Onke did this one but did not finish it}. That's 1 over 2, A squared times B tubed all to the power 2. wayotshintsha la half kwa ngoko to be? {she changed that half immediately to be?} Ngubani kanene? {what is it again?} U 1 over 2 ulingana no power bani? {is equals to which power?} ulingana no 2 to the power ? {it's equals to which power?} ukhona oyi 1 oyifumeneyo qha akafuni ukuthetha. {there is one person who got this right but does not want to speak} u-1 over 2 ulingana no {is equals to} 2 to the power bani?

- {what?}
228. Learners: 1
229. Teacher: 2 to the power minus 1. wenza xa kunjena {you do it like this} and then ibengu {it becomes} 2 to the power minus 1 times how many times? A squared times? Times? yhe Kinana asikagqibi. {Kinana we are not done yet} B 2 times? and then? What is minus 1 times 2? {cannot make out the word} number minus 1 times 2? Ha?
230. Learners: Minus 1
231. Teacher: What is 2 times 2?
232. Learners: 4
233. Teacher: B to the power ?
234. Learners: 6
235. Teacher: Nhe, {right?} and then because we have got negative exponent pha masilungiseni la nto leyana. {let's fix that thing} 2 to the power negative 2 is the same as 1 over?
236. Learners: 4
237. Teacher: Yes, over 4 or 1 over 2 squared. 1 over 4, A power 4, B power 6. Okay ngoku singaya ebreakini. {we can go on break now}

University of Cape Town

[School P7 Lesson 1]

Time # Speech

Notes and comments

- 00:00 1. Teacher: Okay Roxanne ... if six times six is sixty four
2. Learners:: No Miss
3. Teacher: Are you ... sorry, eight times eight is sixty four. Right? What is the square root of sixty four?
4. Learners:: Eight
5. Teacher: Yes .. okay.. I'm not telling you because you asking questions ..um .. asking the others .. um .. if eight times eight is sixty four .. right .. then what is six times six?
6. Learners:: thirty six
7. Teacher: Okay. And what is six squared?
8. Learners:: six squared
9. Teacher: six squared
10. Learners:: I don't know Miss
11. Teacher: Six squared is the same as six times six which is thirty six. Right .. um Farwaaz [walks to learner at back of class] Farwaaz .. what is two cubed? Remember cubed is to the power of threene? Right? So what is two cubed?
12. Learners:: four
13. Teacher: two cubed is not four
14. Learners:: Oh! Is that [gesticulates cube sign]
15. Teacher: [whilst learner is speaking] Two times two times two. So if two ... what is two times two?
16. Learners:: Four
17. Teacher: Four times two?
18. Learners:: Eight
19. Teacher: So ...two cubed is?
20. Learners:: Eight
21. Teacher: Eight. Right. So if two [Learner interjects, inaudibly. Gesticulates cube sign]
22. Teacher: That's two squared ... so .. okay ...so if two cubed is eight .. then the cube root of eight is what?
23. Learners:: [gesticulates cube sign] [inaudible]
24. Teacher: [also gesticulates] With the three
25. Learners:: Of eight? Um .. two
26. Teacher: Er
27. Learners:: Um .. two
28. Teacher: Right. So what do we see? That is .. um .. that square root

and squares ... or square .. er .. numbers ... they work hand in hand isn't it? Farzaan? Isn't it Farzaan?

29. Learners:: Yes Miss
30. Teacher: Farzaan .. or Farzana ... right. So Farzana .. uh .. what is three squared?
31. Learner: [Gesticulates and answers inaudibly]
32. Teacher: Three times three
33. Learners:: Nine
34. Teacher: So the square root of nine is three
35. Learners:: Three
36. Teacher: Three. So what do we see? That they work ...
37. Learners:: Together
38. Teacher: O.K. as this page is .. are there any folds on this page?
39. Learners:No
40. Teacher: So.. if there's no fold, right, we have 1 page, isn't it?
41. Learners: Yes
42. Teacher: 1 half forming 2 parts, right? So, now with 1 fold right, remember, no fold, you have 1 page right, 1 fold you have? [asks the class]
43. Learners: Two
44. Teacher: And how many parts?
45. Learners: 4 parts.
46. Teacher: 4 parts right ... like so..[inaudible word] parts right, now fold that oh! You did fold it.. how many parts do you have?
47. Learners: 4
48. Teacher: you have 8, alright ..[Turns to write in board] so your third fold is equivalent to 8 parts, isn't it?
49. Learners: Yes
50. Teacher: How many parts do you get?
51. Learners: 16
52. Teacher: You can ... just press it down hard with a ruler - [class follows] so you can see your folds[looks at class while folding hers] how many folds do you have now?
53. Learners: Class [shouts out answer] 20 [– some inaudible]
54. Learners: 32
55. Teacher: [Turns to write on board] Who of you got 32
56. Learners: No one
57. Teacher: How many?
58. Teacher: 32 [turns to write on board – turns to class] Can you fold another time?
59. Learners: Ja, Miss

60. Teacher: Right 64 it is [Turns to write on board] 6 folds 64 O.K. , now given the amount of parts to the amount of folds what do you notice? [Waves in front of board] .. Farwaaz?
61. Learner: [Answers inaudibly]
62. Teacher: Is what?
63. Learners: [using calculators] 2
64. Teacher: 1 Try 2 to the power of 2
65. Learners: 4
66. Teacher: 2 to the power of 3
67. Learners: 8
68. Teacher: Are you getting those answers?
69. Learners: Yes Miss
70. Teacher: so.. in other words your er ..um the more parts you have sorry, sorry the more folds er every time you fold, the more parts you produce? Isn't it?
71. Learners: [inaudible – agrees with Ed]
72. Teacher: like you um, you people know that 2 squared um you people are familiar with square numbers and cubed numbers you did that right? So for example 2 squared where 2 is your what?
73. Learners: Your base
74. Teacher: Your base and the 2 on top is?
75. Learners: exponent!
76. Teacher: your exponent, right. O.K. er O.K we also know that 2 squared is equal to what? If you write it out.
77. Learners: 2 times 2
78. Teacher: 2 times 2 you multiply it by itself only once and if : 2 times 2 .. to the power of 2 is : 2 times 2 .. then what is 2 to the power of 3?
79. Learners: 2 times 2 times 2 times 2
80. Teacher: times 2 . right 3 times isn't it?
81. Learners: Yes
82. Teacher: O.K. so if 2 to the power of 2 is : 2 times 2 and 2 to the power of 3 is : 2 times 2 : times 2 times 2. then what do think is 2 to the power 1?
83. Learners: is 2 , 2 times
84. Teacher: However, if I put, if I put 2 on top [shows on the board]or as an exponent or a 3 on top as an exponent then it becomes 2 to the power of 2 and 3 to the power of 3 or 3 to the power of a hundred and so on do ..do you get me?
85. Learners: Yes
86. Teacher: right, so now like I said 2 to the power of 1 is mos 2, so anything to the power of 1 is that number Are you clear on that?
87. Learners: Yes Miss
88. Teacher: Right so now is it safe to write our powers on our our free standing numbers here [points to board]
89. Learners: yes

90. Teacher: right so we can write our powers, so, what do you notice .. what do you notice concerning er multiplying exponents, or exponent numbers
91. Learners: Plus!
92. Teacher: Plus! What do you plus
93. Learners: Plus the one ..the one [another L. interjects] The exponents
94. Teacher: You add the exponents, isn't it? So .. there you have it.. you have a rule
95. Learners: [interjects inaudibly]
96. Teacher: In a er when er in in multi multiplications of er exponents, you add the? [waits for reply .. inaudible] Sorry in the base, oh, and you notice that the bases are also all the same. Can ad d your exponents and keep your base. Isn't it?
97. Learners: Yes
98. Teacher: Your bases are the same and you added your exponents. Is that, Is that correct?
99. Learners: plus [L. interjects] what .[.inaudible] Miss now it looks Miss?
100. Teacher: If I'm gonna have er .. maybe 2 squared times 3 squared , is that what you asking me? is different.
101. Teacher: 2 to the power of 2. times 2 to the power of 3. what do I do
102. Learners: Times the base [another L.] Times the base.
103. Teacher: First what do you do with your base?
104. Learners: [inaudible] [more than one learner speaking]e: Keep your base.
105. Learners: yes
106. Teacher: and you get your answer you write it er you can write it out er or you can just um check on your Calculators. 2 times 2 times 2 times 2 times 2 isn't?
107. Learners: Yes Miss
108. Teacher: Right, so 2 times 2 is what?
109. Learners: 4
110. Teacher: 2 times 4 is what?
111. Learners: 8
112. Teacher: 8 times 2 is what?
113. Learners: 16
114. Teacher: 16 times 2 is
115. Learners: 32
116. Teacher: 32! Do you understand that now?
117. Learners: Yes Miss
118. Teacher: Right, so our bases are the same, and we add our exponent isn't it?
119. Learners: Yes Miss
- 120.

121. Teacher: O.K. now er another one 3 to the power of times 3 times 3 to the power of 2. what do we do? er ..er . [looks around Class, calls a name] Nathier?
122. Learners: Nathier [Class: murmuring]
123. Teacher: Tarryn nuh? Tarryn
124. Learner: you keep the 3 nuh Miss?
125. Teacher: so this now is the new sum. So how do I express it? Like this {writes on board]
126. Learners: 3 times 3 times 3 times 3 times 3
127. Teacher: Now now I want the answer now..now you times 3 times 3 is?
128. Learners: and Teacher: 9 .. 9 times 3 is 27
129. Teacher: 27 times 3 is?
130. Learners: 50.. 50 54 [laughter] 51!
131. Learners: 81 ..81
132. Teacher: times 3 times
133. Learners: 81
- 134.
135. Learners: 243
136. Teacher: 2 hundred and?
137. Learners: 43
138. Teacher: right so that first you write an exponent form then you express it, then you give the answer .. right we understand that?
139. Learners: Yes Miss
- 140.
141. Teacher: Now this here is indeed a rule of multiplication for multiplication of exponents where your base are the same and you add your exponents. Are we clear on that?
142. Learners: Yes
- 143.
144. Teacher: Fawaaz, why are you walking around?
145. Teacher: What do you want? [walking toward L.] Zahier [inaudible – sounds like] Sadien
146. Learners: Sadien
147. Teacher: Can she sit next to you?
148. Teacher: Wiedaad! Write finish! Where's your content?
149. Learner: [Wiedaad says something inaudible]
150. Teacher: When you done I need you to do something else for me quick nuh?
151. Teacher: Firstly, why aren't you writing in here?
152. Learner: In my bag Miss!
- Teacher: No! but you were sitting there also. now how come you not writing ?

Teacher: Are we all halfway yet?

Learners:

Teacher: Are we done?

Learners: Yes,

Another Learner: No!

Teacher: 75? [to a learner whose work is being checked], 75, the following.

Teacher: Are we done?

153. Teacher:

1 to the power of anything is?.. one to the power of anything ..any number 1 to the power of 10 1 to the power of a hundred one to the

..

154. Learners: 10

155. Teacher: 1 to the power of [indistinct] is equal to 1 times 1 isn't it?

And 1 times 1 is ..1 to the power of 3 is equal to 1 times 1 times

1 .. 1 times 1 is 1: 1 times 1 is 1 and so on so, its always gonna be 1

156.

Teacher writes examples on the board:

$$3^2 \times 3^3 = 3^5$$

$$4^2 \times 4^1 = 4^3$$

$$8^1 \times 8^1 = 8^2$$

$$9^3 \times 9^2 = 9^5$$

157.

Learners do exercises in their books.

Teacher marks learners' work.

39:11 158. Lesson ends

[School P7 Lesson 2]

Time	#	Speech	Notes and comments
00:00	1.	Teacher: Why you stand up? Stay up ... stay up .. move away from the desk. Thank you. .. Okay. [Learners very noisy throughout the lesson.] Hilton .. What is a prime number?	
	2.	Learner: <u>Yo</u> {Wow}, miss!	
	3.	Teacher: Not <u>Yo</u> {Wow}, miss! What is a prime number?	
	4.	Learners: Five. Five.	
	5.	Teacher: That is an example of a prime number. I'm asking what is a prime number? ...	
	6.	Learners: [Inaudible]	
	7.	Teacher: ... If five is a prime number, why is five a prime number?	
	8.	Learner: [Inaudible] Prime number {inaudible}.	
	9.	Teacher: There we go, he said prime numbers only has two factors ... Who said you can sit? Only has two factors .. itself and one isn't it?	
	10.	Learner: Yes, miss.	
	11.	Teacher: Right. Kevin .. No not you Kevin Uhm. .. Suleiga what is a composite number?	
	12.	Learner: [Inaudible]	
	13.	Teacher: If a prime number only has two factors right. The composite number is the other one. ... [01:00]	
01:00	14.	Learners: [Inaudible]	
	15.	Teacher: [Inaudible] the form ..	
	16.	Learner: [Inaudible]	
	17.	Teacher: Yes .. you. Two, oh. If..square, if uhm, the square root of four is two, what is two squared ?	
	18.	Learners: [Inaudible]	
	19.	Teacher: Um .. Keep standing uhm ... Zakariyah	
	20.	Learners: [Inaudible]	
	21.	Teacher: Zakariyah!	
	22.	Learners: [Inaudible]	
	23.	Teacher: Nobody's reading ... Zakariyah .. What is the square root of sixteen	
	24.	Learner: Huh.	
	25.	Learner: [Inaudible]	
	26.	Teacher: The square root of sixteen Is not eight Zakareyah. The square root of sixteen is not six, Zakariyah.	

Which figure holds the square root of sixteen.. uhm

27. Learner: [Inaudible]
28. Teacher: No! ... [Inaudible]
29. Teacher: The square root of sixteen ..
30. Learner: [Inaudible] .. square root of sixteen..
31. Teacher: The square root of sixteen...guys and girls..
32. Learner: It's four Miss
- 01:59 33. Teacher: Right. If the square root [02:00] of sixteen is four, ... then four squared is what?
34. Learners: Sixteen.
35. Teacher: Ssixteen ... if two to the power of three.. or two cubed is what? Anybody!
36. Learner: Eight.
37. Teacher: Eight ... Then what is the cube root of eight?
38. Learner: Two.
39. Teacher: Two .. If three cubed is twenty-seven what is the cube root of twenty-seven?
40. Learners: Three.
41. Teacher: Three ... So what do we notice? [Gesticulates to Learners]
42. Learners: [Inaudible] ... They work together. ... Opposites.
43. Teacher: Yes. Now you may sit down and take out your books. ...
44. Learners: [Sit down very noisily.]
45. Teacher: Without having to speak, I notice ... I notice ... Can you .. Can you all listen now?
46. Learner: [Inaudible]
47. Teacher: What that?
48. Learner: [Inaudible]
49. Teacher: Did .. Did you write..
- 03:00 50. Learner: Miss!
51. Teacher: Just give me your ...I'm going to look into my other batch uh..
52. Learner: Miss can I ask you something?
53. Teacher: Yes
54. Learner: What is wrong from this?
55. Teacher: Come.[Looks at learner's book.] ... The question was, the multiples of twelve. You wrote the factors of twelve.
56. Learner: Oh..yes.

57. Teacher: Right! We all know what natural numbers are, right? What are natural numbers?
58. Learners: One, two, three, four, five..
59. Teacher: And so on right? Etcetera.
60. Learner: Seven, eight.
61. Teacher: Right so, if I ask you to give me the integers between negative five and ten,.. right, the first thing you do is you draw your number line ... right...
62. Learner: Negative four
63. Teacher: You draw your num.. ... right, you draw your number line ... ne {right} ...and remember we said our number line runs between negative five and ten [writing on board] isn't it?
- 03:58 64. Learners: Yes. [04:00]
65. Teacher: ... Right so what do I do. ... If I'm listing the integers between ..remember.. What is an integer first of all?
66. Learners: It's minus.. um ,, Minus
67. Learner 2: It's positive and negative.
68. Learner 3: It's negative and positive.
69. Teacher: Including?
70. Learners: Nought
71. Teacher: Including? .. Zero.
72. Learner: Including whole numbers.
73. Teacher: Including Zero ... Including ... say again?
74. Learner: Including whole numbers.
75. Teacher: Whole numbers. Ja {Yes}. Right, so we said between negative five and ten. Right so we draw our number line [Writes on board]. Board too faint to see what she's writing.
76. Learner: Ten line
77. Teacher: Right[writes on board] so, nought, one ,two, three, four, five, [04:40] Board shot
78. Learners: Six, seven.
79. Teacher: Eight, nine, ten.
80. Learners: Eight, nine, ten.
81. Teacher: Right and remember ... integers are negative numbers as well ..
82. Learner: Minus one
83. Teacher: So we move back negative one, negative two, negative three, negative four, negative five. Right? So if I ask you to list all numbers between negative

- five [05:00] and ten, ... you list them.
- 05:02 84. Learner: Yes.
85. Teacher: On the number line. ... To make it easier for yourselves.
86. Learner: So must we just list naught, minus one, minus two, minus three, minus four ..
87. Teacher: Basically everything that is here.. you list.
88. Teacher: Right, and another thing I notice a lot of you can't do is, or either misinterpreted was....oh...first of all, what is a composite number?
89. Learners: Uhm... Opposite number of er..er...er prime number.
90. Teacher: Okay, What is a prime number?
91. Learner: Five and something like that.
92. Teacher: Those are examples of profits...er prime numbers right, so therefore a composite number instead of having just two factors, itself and one, a composite number has more than two factors...For example
93. Learner: Six.
94. Teacher: Six. And six factors are?
95. Learners: One, two, three and six and ten.
- 05:55 96. Teacher: Ten is an example of a composite number. When I ask to list composite numbers...I don't mean [06:00] give me the factors of it. I mean just give examples of composite numbers. Then you just write four ,six, seven, twelve, and all those other things, right? All those other composite numbers, right? And if I ask you .. one of the questions [interrupted].
97. Learner: [Inaudible].
98. Teacher: ... Ja {Yes}. .. I ask you to give me three numbers that are positives ... right? And what is a positive number? Look at the number line again. What....
99. Learner: All the stuff on the right.
100. Teacher: All those things going that way are positive numbers isn't it?
101. Learners: Yes Miss.
102. Teacher: Right, so I ask you to give me three numbers which are positive... um that are positive and rational, and what is a rational number?
103. Learner: Numbers that are ...
104. Learner 2: Three, zero, nine ..
105. Learner 3: [Inaudible] that are [inaudible]

106. Teacher: Okay. Remember tree we drew.... Okay not a tree but a steps from rational numbers up to integers right, we have er..
107. Learner: It includes all integers, whole numbers, and...
108. Teacher: We have rational, then we have integers, er...
- 07:00 109. Learner: Natural numbers.
110. Teacher: No...First whole .. then natural right.... and we said that rational numbers include all the numbers below, all the numbers that are integers, all the numbers that are whole numbers, all the natural numbers including fractions, be it mixed fractions ... right? ,, Er.. improper fractions, like where the numerator is more than the denominator... er ... or whats the other one, or normal fractions like half and a quarter and all those things. So we said that rational numbers is everything, So I said list three numbers that are .. what is it .. positive and rational right? So now you just list any three numbers that side of the number line, whether it is one, two, three, four, five, six, seven, eight, nine, ten, or one, a half, a quarter and all that, but do not tell me one and then you give me negative a half, positive a half ... because we asking you for [08:00] positive rational numbers. Just positive numbers. Numbers that only has a positive attached to it. .. Do we get that?
- 08:10 111. Learner: So we must just write if it is like .. positive numbers we must just write a six and a comma after that.
112. Teacher: Ja. {Yes}. Like basically all those numbers...
113. Learner: And if they say a negative half, then must you write...
114. Teacher: If I ask you to list negative ... uh .. uh .. three negative numbers, and it must be rational, then you can list any negative numbers this side of the number line, including any fractions you want to but those fractions must carry a negative. ... It must have a negative sign.
115. Learner: So you can't put a ... positive .. fraction by ... a ... negative number?
116. Teacher: What do you mean now?
117. Teacher & Learner: [Inaudible]
118. Learner: You can't ... must it ... must it be a negative .. um fraction .. to be with a negative number? Can't it be a negative number with a positive .. fraction.
119. Learner 2: With a positive fraction
- 08:58 120. Teacher: A negative number with [09:00] ... A negative number for example one with a positive fraction?

121. Learners: Yes ... like a half.
122. Teacher: Like so?
123. Learner: Can there be like that ... must it be...
124. Teacher: No. It must just be listed. But a half ... [someone coughing drowns out other voices.]
125. Learner: It can't be.
126. Learners: [Inaudible]
- 09:20 127. Teacher: When I say list ne {okay}, all I'm just asking you is just to give me. ... Say now I say list three ... I'm asking you to give me three examples of any positive um .. positive rational numbers. That was the question right? Any three positive rational numbers. So you just think of any three numbers that are positive ... oh ... lets think of a ..one, two, three, four, oh those are all positive numbers. Okay but it must be rational. ...Okay but now one, two, three, those are also ... also rational numbers. ... But if um.. but like I said ... like Lameez said that rational numbers are also fractions. So you can include fractions. ... You don't have to, but you can. ... Because you know [10:00] that rational numbers are fractions and are .. including fractions as well. .. Are you with me?
- 10:07 128. Learner: No.
129. Learner 2: Not really.
130. Learner 3: Not really Miss.
131. Learner 4: Almost there Miss.
132. Teacher: Okay. This is my other number line right. ... Now I have for example a half, one, one and a half, two, negative a half, er ... negative one, negative one and a half, and negative two. Right. Now we said ... remember this number line is just a double set of integers, because integers are negative whole numbers and positive whole numbers. Whereas erm .. rational numbers includes negative numbers negative one, negative two, positive one, positive two, including negative one and a half or in other words including fractions: half, and um one and a half. Do you see the number line here. [10:30] Board shots.
- 10:59 133. Learners: Yes Miss.
- 11:00 134. Teacher: Right you see negative ...
135. Learners: Yes Miss.
136. Teacher: Well now this number line ... are just ex .. just examples of rational numbers ... whereas this number line is examples of integers.
137. Learner: Ja {Yes}.

138. Another Learner: Now what is the rational numbers?
139. Teacher: Isn't it?
140. Learner: Yes Miss.
141. Teacher: Do ... do you get it now? Can you see the difference?
142. Learner: There is a half. Miss ..
143. Another Learner: There is a half number line and you get a ... that number line. Now Miss, what I am trying to say is ... can't .. can you put a negative number with a positive fraction. That is what I am trying to say.
144. Teacher: But then you're not listing it ... then it ... then you're talking about something. Do you mean like ... do you mean like for example two plus a half.
145. Learner: No Miss ..
146. Teacher: I'm not talking about ..
147. Learners: {Inaudible}
148. Teacher: Come show me what you mean ... come show me what you mean. Please.
149. Learners: Okay. [Laughter].
150. Learner: Miss I'm talking about say maar so {let's say} a minus two Miss, with a .. half. Can it be like that.
151. Teacher: Which means minus two and a half and here you have minus one and a half.
152. Learner: Now that is what I am asking.
153. Another Learner: Yees.
154. Teacher: Oh sorry I didn't hear.
- 12:00 155. Learners: [Inaudible]
156. Teacher: This is an example of a rational .. this is an example of a negative rational number ... whereas this here is an example ...
157. Learner: Miss, so if ... if it's a negative number then that whole thing is a negative.
158. Teacher: Yes.
159. Learner: I understand.
- 12:18 160. Teacher: Right ... this is an example of a negative rational number ... but this here is an example of a positive rational number. This is an example .. of a negative number as being an integer, and this is an example of a positive two as being an integer also. Now you must remember that er ... [writes on board] that this here can be an integer, but it can also be a natural number and it can be a whole number isn't it?

161. Learner: Yes.
162. Teacher: Because natural numbers are all numbers from one up. Whole numbers are all numbers. From zero up isn't it?
163. Learners: Yes Miss.
164. Teacher: Why are you talking! Somebody's talking at the back.
165. Learner: Kurt, Miss.
166. Another Learner: Nobody's talking.
167. Teacher: I heard a man or a boy's voice.
168. Learners: It's there. [13:00] It's Miss ... it's there.
- 13:02 169. Teacher: So do we understand the difference between a rational number and an integer? Integers are just whole numbers, rational numbers has fractions as well ...
170. Learner: [inaudible]
171. Teacher: Errrr ... When I ask you people. ... If I ask you to list a multiples of six, I'm simply asking you to think. ... Thank you. ... to think of the multiplication table time table, Hilton. Thank you Hilton.
172. Learner: So you must say six times six.
173. Teacher: Not the factors of six, the multiples of six.
174. Learners: [Inaudible]
175. Teacher: Errr ... Write this. I just want to do this one. This one is like most important. I want to just quit here. [Writes on board] ... If I give you a list of numbers ne {right}, for example nought comma five [14:00] was the one then five was negative six, err ... negative a half, err ... a half, err ... zero over two. ... [Still writing on board] ... [13:50] Board shots difficult.
- 14:36 176. Learner: Miss that koki not writing so ...
177. Teacher: Bring me another one. ...
178. Learners: ... [Inaudible] ...
179. Learner: A black one. ...
180. Teacher: Right. Remember I gave you a list of numbers ... let me rather keep all by me till it is empty. You know ne {hey}, they were all working perfectly before you [inaudible].
- 14:58 181. Observer: Miss ... Pump them ... pump. Just give me that one there. [15:00] Gimme the ... not that kind, the other one .. ja {yes}. Just pump them. You do that. [Shows the teacher.]
182. Teacher: Oh.

183. Observer: Then they work.
184. Teacher: Goodness gracious is it ... [Laughs]
185. Observer: Ja {Yes}. Do it with all of them then. [Teacher pumps pen] Working now? [Teacher writes on board].
186. Learner: Pump it more.
187. Teacher: Nought comma five, five, negative six, negative a half. Negative ... err ... sorry, zero over two, square root five, zero, five remember we said ... we worked out what five
188. Learner: Five
189. Teacher: What five is worked out for twenty-seven over err ... twenty-two over seven, this long number and negative four. Right? And what did we say about er ... non recurring numbers?
190. Learner: Irrational numbers.
191. Another Learner: [Inaudible].
192. Teacher: What we say about non recurring numbers?
193. Learner: It's irrational numbers.
194. Teacher: Okay. So. Immediately when I look at this set of numbers ne {okay}, and I ask you what are the natural numbers. What would you say?
195. Learner: Five.
196. Teacher: Only five? ... Only five?
197. Learners: Five, two, seven, five, five and miss three, five, one.
- 15:58 198. Teacher: What are the natural numbers here? [16:00] Keep in mind what is a natural number.
199. Learners: Five, one, five, two, eleven [Others shouting ... inaudible]
200. Teacher: Natural numbers are mos {simply} just one and up isn't it?
201. Learners: Ja. {Yes.} It's wrong.
202. Teacher: So, of all these numbers, which are the natural numbers?
203. Learner: Five, five, five.
204. Teacher: Only five. [16:15] Board shot
205. Learners: [Inaudible]
206. Learner: Why not six.
207. Teacher: Right.
208. Learner: Nought and five.
209. Teacher: So anyway. What is a whole number?

210. Learners: Nought and five. Nought and five. Nought, one, two, three
211. Teacher: So what examples of naw ... of a whole number
212. Learner: Nought and five.
213. Teacher: Now I'm er ...
214. Learner: Nought and five.
215. Another Learner: Nought comma five, Miss.
216. Teacher: Nazier ... I need you to listen here... listen. ... Right. So we said this is a whole number and examples of whole numbers are?
217. Learners: Nought and five.
218. Teacher: In this case nought and five. Right? [16:50] Board shot.
219. Learner: And five.
220. Teacher: Err ... Integers ... What are integers here?
221. Learners: Minus four and minus six.
222. Teacher: Okay. Again I say when we think integers, you think negatives, positive numbers ..
223. Learners: Positive numbers
224. Teacher: .. and zero.
- 17:00 225. Learner: Yes.
226. Teacher: That's the only three things you think of. Negative, whole numbers, positive whole numbers and zero.
227. Learner: Zero.
228. Another Learner: Miss, zero minus.
229. Teacher: Right. So my integers are ...
230. Learners: Five, nought, minus four, minus six.
231. Teacher & Learners: Nought, minus four, minus six. [17:15] Board shot.
232. Teacher: Are that the only ones?
233. Learners: Yes Miss.
234. Teacher: Nought, minus four. Now. Okay. Now I ask you for my rational numbers. Remember rational numbers include ... already you have to know, that because I said rational numbers include natural numbers, whole numbers and integers, Immediately you know that all of these here[waves to show figures on board] ...
235. Learners: Must be rational numbers.
236. Teacher: Are all rational numbers already ... already. So we write our five down, our nought, ... sorry .. and ... what is it? Negative four, and negative six, right? Now what else are also rational numbers we said. Remember we said rational numbers are all [17:46] Board shot.

- negative numbers, ..
237. Learner: Miss
238. Teacher: .. positive numbers, zero, including ...
- 18:00 239. Learner: Nought.
240. Another Learner: Fractions.
241. Teacher: Fractions.
242. Learner: Fractions.
243. Learner: Minus nought, ... minus nought, minus two,
244. Teacher: No wait what we...where we now?... Where we now....anyway,
245. Learner: Miss can you get minus nought
246. Learners: [Inaudible]
247. Teacher: Minus a half.
248. Learner: Miss ... nought comma five ... I mean nought and five.
249. Teacher: Nought over two is one. That's a fraction.
250. Learner: Twenty-two over seven
251. Teacher: Twenty-two over seven
252. Learner: Minus one over two
253. Another Learner: To the power of
254. Teacher: No ... where's [inaudible] we got it already. Is that it?
255. Learners: Yes Miss.
256. Teacher: Right. ...
257. Learner: There must be two ... two
258. Teacher: Okay irrational numbers.
259. Learners: Five, two comma two ... comma two ... three ... one ..
260. Teacher: Sorry, and the ..
261. Teacher & Learners: Two, comma two ... one, three and five .. five, seven, nine, five
262. Teacher: Right.
263. Learner: Nought comma five.
264. Teacher: And what else.
265. Learners: Nought and there's five. .. Miss.
266. Teacher: And what else.
267. Learner: Miss that ..
268. Another Learner: Two over seven.

269. Teacher: Square root of five
270. Learner: Square root of five
271. Teacher: Okay now how do we know that these are ... are ... are ... are ... are ... irrational numbers? How do we know that?
272. Learner: Recurring.
- 19:00 273. Teacher: Okay furthermore they are non recurring .. Irrational numbers are non recurring.
274. Learner: They continue.
275. Teacher: They uhm ... and they non terminating, so they don't stop.
276. Learner: Do they continue over and over again ...
277. Teacher: Right, and then you work out square root of five ... what do you get such a number?
278. Learners: Yes .. twenty-five .. yes Miss ... and non recurring numbers... yes.
279. Teacher: As well as five.
280. Learner: Now why is this ..
281. Teacher: Now those people who didn't fill in this part of the test, do you see now what to do?
282. Learner: Yes Miss; Yes Miss; Yes Miss:
283. Teacher: Oh, sorry we forgot about real numbers. [Writes on board.] [19:36] Board shot.
284. Learner: It's old numbers miss, seven, three
285. Teacher: Real numbers would then be everything.
286. Learner: Everything ..
287. Another Learner: It's all the numbers Miss.
288. Teacher: But don't please, next time, don't write all the numbers, then you draw a arrow up ... please don't do that ... you write out the numbers ... ne {okay}?
289. Learners: Yes Miss.
290. Learner: It's easy.
291. Teacher: Ne {okay}? ... You just repeat .. repeat the numbers ... repeat all these numbers.
292. Learner: Miss they don't do all the work.
293. Teacher: Well then you not gonna get a mark next time.
294. Learners: [Inaudible]
- 19:59 295. Teacher: Right. [20:00] So, um .. those just ... um ... those of you who didn't fill in this part, just fill in this part for me please, as well as the others ... you got

- ... oooh you got no time.
296. Learners: [Inaudible]
297. Learner: Is twenty-five, to, three ... is twenty-five, to , three..
298. Teacher: Okay now ... let us mark then the ... exercise.
299. Learners: [Inaudible]
300. Teacher: Okay. If I ask you guys, and girls...
301. Learner: Shhh...Shhhh
- 20:43 302. Teacher: Guys and girls ... thank you Courtleigh ... right. If I ask you to write five raised to the power of four [inaudible] ... I simply mean that you going to write it out like this [writes / $5 \times 5 \times 5 \times 5$ /] ... [21:00] that's it. Is that four times?
- 21:02 303. Learner: Ja {Yes}.
304. Teacher: Because why, why did you write it out so? Because five times five times five times five is the same as five to the power of four, and what do we do with our exponents?
305. Learner: You add them.
306. Teacher: We add them. In multiplication ... when you multiply um ... exponents, and your bases are the same, you keep your base and you add your exponents.
307. Learner: Exponents.
308. Teacher: Then ... you can find that ... the answer to that ... but I didn't ask for that.
309. Learner: Is that a three Miss?
310. Teacher: What is?
311. Learner: It's five.
312. Another Learner: It's five. [21:39] Board shot.
313. Teacher: Right ... er ...
314. Learner: Miss, must we do that exercise ... [another] ... there's no time.
315. Teacher: What exercise? ... You suppose to be done with this exercise.
316. Learners: [Inaudible] Yes Miss.
317. Learner: Must we put in the ... front Miss?
318. Learner: Miss I just didn't know that one by two point two.
- 21:54 319. Teacher: No. Keep it so long...Keep it so long. I must still give you [inaudible].
320. Learner: Miss [inaudible] ... [22:00] ...
- 22:06 321. Teacher: What's this now?

322. Learner: How did you get the answer ... [inaudible]
323. Teacher: This answer?
324. Learner: Do you just write one.
325. Teacher: This answer.
326. Learner: No! The other one.
327. Learners: [Inaudible]
328. Teacher: Right. Can you just listen here quickly man? ... Remember when we said that if the bases were the same we keep our base ... our base ... why?
329. Learner: Is that , is that the one[inaudible]
330. Teacher: Then you add the exponents because the bases are the same ... so ten plus ten plus five is what?
331. Learner: twenty-five
332. Teacher: twenty-five ... That's it ... [someone says] oh!
333. Teacher: And one to the power of twenty-five is what?
334. Learner: Umm ... twenty-five!
335. Learner: one ... one ... one
336. Teacher: You're not sure of that. ... What is one to the power of twenty-five?
337. Learners: one .. one .. five ... twenty-five
338. Teacher: one to the power of twenty-five?
339. Learners: one ... twenty-five ... twenty-five
340. Learners: one...twenty-five. .. One times one times one .. One times one times one. .. One x one
341. Teacher: And what is one times one?
342. Learners: One.
343. Teacher: One times one?
344. Learners: One.
345. Teacher: One times one?
- 23:00 346. Learners: One.
347. Teacher: One times one?
348. Learners: One.
349. Teacher: So?
350. Learners: [Inaudible]
351. Teacher: So one So one raised to any power is one.
352. Learners: [Inaudible]
353. Learner: Only one. .. [Inaudible]
354. Teacher: Right ... The same thing goes here ... one times one [23:19] Board shot.

- ... one to the power of one times one to the power of one ... one to the power of two is equal to one. [23:29] Board shot.
 ... Er ...
355. Learner: Miss the bell did ring.
356. Learner: The bell didn't ring ... the bell ... [Inaudible]
357. Learners: [Inaudible] .. The bell rang, Miss. [Inaudible] Miss [inaudible]
358. Teacher: I think that this is ... [Inaudible]
359. Observer: Errr .. nearly half past.
360. Learners: [Inaudible] [24:00] ...
- 24:05 361. Learner: Miss ... Miss ... must choose me as the monitor
362. Teacher: Oh ja {Yes}, oh ja {Yes} ... the monitor [24:08] Board shot.
363. Learners: [Inaudible] ... Me Miss
364. Teacher: No ... No ... I choose ... I choose
365. Learners: [Inaudible]
366. Teacher: I'm choosing the monitor... and I'm choosing it tomorrow morning.
367. Learners: [Inaudible]
368. Teacher: Okay And another thing .. ummm .. another thing ... Did you sort out who's gonna be the M.C. for the ...
369. Learner: Me Miss ... Me Miss
370. Teacher Nazier sit down and ... er ...
- 24:37 371. End of lesson.

School P7 Lesson 3

Time	#	Speech	Notes and comments
00:00	1.	Teacher: [Indistinct] What do we remember about ..exponents?	
	2.	Learner: We can add them.	
	3.	Teacher: How can? When can you add exponents? Why is	
	4.	Learner: When the base is the same.	
	5.	Teacher: Why is[indistinct]	
	6.	Learner: What?	
	7.	Teacher: You were talking now. ... Right, Andre said you can add them. What can you add?	
	8.	Learner 1: The exponents	
	9.	Learner 2: When the base is the same	
	10.	Teacher: When the base is the same, you add the exponents when multiplying, isn't it?	
	11.	Learners: Yes, Miss.	
00:30	12.	Teacher: Okay . [Long silence as teacher pauses to think, then writes $\frac{2^4}{2^2}$ /on the board]	
00:59	13.	Teacher: Right, are we all listening? [01:00]	
	14.	Learners: Yes.	
	15.	Teacher: Okay. Isn't two to the power four divided by two to the power two the same .. sorry .. ja {yes} anyway .. the same as .. [develops equation $\frac{2^4}{2^2} = \frac{2^1 \times 2^1 \times 2^1 \times 2^1}{2^1 \times 2^1}$ / on board as she speaks] er .. two times two times two times two isn't it?	
	16.	Learner: Yes Miss.	
	17.	Teacher: Remember anything raised to the power four .. you write it up four times. ...	
	18.	Learner: Four times	
	19.	Teacher: Okay? And two to the power two is the same as ..	
	20.	Learners: Two times two	
	21.	Teacher: Okay. ... And they're all to the power one. So looking at that, right, can you simplify it .. or how can I say er What is two divided by two equal to?	
	22.	Learners: One.	

23. Teacher: One. Isn't it? Why? Because we divide two into ..
24. Learner: Into two once.
- 1:58 25. Teacher: Once. Right? Equals one. Isn't it? [02:00] So can't you do the same thing here?
26. Learners: Yes
27. Teacher: And how do we do that?
28. Learner: By ...
29. Teacher: How do we do that? ... Fawaaz? First Fawaaz if you can tell me what what do I do here then you can sit down.
30. Learner : [Indistinct]
31. Teacher: What can I do here? Remember two divided by two is one
[Writes $\frac{2^4}{2^2}$ Three divided by three is .. one. Four divided by four is .. one. [Writes the examples on the board./] So what can I do here to get ..
32. Learner 1: Times it.
33. Teacher: To get one.
34. Learner 2: Times it by two Miss.
35. Teacher: What?
36. Learner 3: Times it Miss.
37. Teacher: No, I want to simplify this. ... How do I do that?
38. Learner: Times by two Miss.
39. Learner: Miss, two goes into four.
40. Teacher: No, man.
41. Learner: Mustn't you first add it?
42. Teacher: Is there nothing that we can divide by here? What is .. what is similar between our numerator and denominator?
43. Learner 1: Two divide by two.
44. Learner 2: It is the same.
45. Learner 3: No .. the denom .. the numerator is bigger than the denominator.
46. Teacher: Okay, okay. We have four two's .. we have four two's on top and two two's at the bottom. Isn't it?
47. Learners: Yes Miss.
48. Teacher: So.
49. Learner 1: Four divide by two.

50. Learner 2: The numerator is bigger than the denominator. [03:00]
- 3:01 51. Teacher: Is .. is .. what is bigger There's ... it's the same
52. Learner: Miss then it's mos {actually} one.
53. Teacher: Can't you cancel one?
54. Learner: Yes you can.
55. Learner: You carry it over.
56. Teacher: Did you people do this last year?
57. Learners: /Various responses/ No ... yes ... no
58. Teacher: Anyway .. anyway .. okay
59. Learner: Okay .. ne {okay}.
60. Teacher: So two can be divided by two. Isn't it?
61. Learners: Yes.
62. Teacher: And one two can be divided by another two. Isn't it?
63. Learner: Yes.
64. Teacher: And how many twos are you left with?
65. Learners: Two.
66. Teacher: Two twos. Isn't it?
67. Learner: Yes.
68. Teacher: Which is in actual fact two to the power two. Isn't it?
69. Learners: Yes.
70. Teacher: Because we said that two times two is two to the power two.
71. Learners: Yes Miss.
72. Teacher: Right. Now .. er .. let's do another one.
- 03:35 73. Learner X: Miss.
74. Teacher: Yes?
75. Learner X: Before Miss now go to the second one ne {okay}, why did Miss cancel that one? Now why? Did you just sommer {simply} decide ...
76. Teacher: Because they are the same.
77. Different learner: They are the same.
78. Teacher: It's like dividing. It's like dividing ... two divided by two. Do you see. [04:00]
- 04:00 79. Learner X: If it's .. say maar so {for instance} the two ... wait ... is six nê {okay} Miss ... there on top

80. Teacher: Yes, here ... (chair noise makes sentence unclear)
81. Learner X: Say maar so {for instance} the two .. the un .. the denominator makes two and three ... and then there's two times three mos {okay}.
82. Teacher: Yes.
83. Learner X: And then the top one ... say maar so {for instance} it's two times six.
84. Teacher: Come here and write down what you are talking about.
- 04:29 85. Learner X: Miss, say maar so {for instance} it's two and six ne {right} Miss ... one .. two .. three .. four Six times ne {right} Miss ... and then two and three and you only make .. /inaudible – loud background noise/ and then must you scratch three out because here's three?
86. Different learner: Yes.
87. Teacher: Okay It's good that you put it that way.
88. Learners: Yes.
89. Another learner: Until you can't ..
- 05:00 90. Learner X: Must you [05:00] .. must you scratch this out ..
91. Teacher: Okay .. you start with your first one. You divide your first one by your first one .. your first two by your first two .. your first two of your numerator by your first two of your denominator .. then the second two of your numerator you divide by your second two of your denominator. Is there any other thing you can divide by?
92. Learner X: No.
93. Teacher: So what are you left with?
94. Learner X: Two.
95. Teacher: Just two to the power two. Isn't it?
96. Learner X: Yes.
97. Teacher: Okay, now you do the same thing with any...
98. Learner: Miss, someone .../ mostly inaudible/ ... soccer players ...
/Aside by a learner to the teacher, reminding her of some meeting notice. She responds./
- 05:38 99. Teacher: Um leave it there. Keep it there. Just keep it there. I'm gonna get it.
Right. So we do the same thing with the four. Four to the power three .. which is?
100. Learners: Four times four times four .
101. Teacher: Four times four times four. Right. And at the bottom?
102. Learners: Four times four.

103. Teacher: Four times four. So what do we do now?
104. Learners: We cancel the two.
105. Teacher: Okay. Four divided by four equals one. /Writes examples on the board./ Isn't it? And one [06:00] times four divided by four is also one. Right? So what are we left with?
106. Learner: Four.
107. Teacher: Four to the power one .Right.
- 06:09 108. Learners: Four to the power one.
109. /Teacher pauses to think of another example and writes $\frac{8^6}{8^3}$ on the board./
- 06:33 Teacher: Right. Now we write this one full out and how do we do that?
110. Learners: Eight times eight times eight times eight times eight times eight.
111. Teacher: Eight times eight times eight times eight times eight times eight. [Counts] One two three four five six. And at the bottom? Eight times eight times eight. Right. So now we divide eight divided by eight times eight divided by eight which is one. Remember? Times eight divided by eight. Right? [07:00] Now remember
- 07:02 112. Learner: Three to the cubed.
113. Teacher: Eight to the power of three.
- 07:05 Now let's go back to this sum. What do you see? What do you notice concerning my exponents? Wwhen you are dividing? ... What do you notice?
114. Learners: /inaudible responses/
115. Teacher: Look at the exponents. ... Remember when you're multiplying .. when you multiply and your bases are the same, you add your exponents. Right? So what do you notice? What are you doing when you are dividing?
116. Learner: You divide .
117. Teacher: What, what are you doing with your exponents when you are dividing?
118. Learner: You're dividing it.
119. Teacher: Look at the exponents. That's four .. that's two and that's two. Right? Look at the exponents. That's three and that's two and this is one.
120. Learner: Subtract.
121. Teacher: You scratch out.
122. Learners: Kids calling out different answers
123. Teacher: Somebody said subtracting.

124. Learner: Miss, Miss
125. Teacher: Somebody said subtracting. Now see again here. Eight to the power six divided by eight to the power three gives eight to the power three. So look at your exponents. What is it?
126. Learner: Minus three
127. Learner: You minus [08:00]
- 08:00 128. Teacher: What do you minus by?
129. Learner: You minus the three
130. Learner: You minus the powers Miss.
131. Teacher: You minus /noise from outside/. These people ne {right}. Your exponents. You subtract your exponents. Six minus three is?
132. Learner: Three
133. Teacher: Three. Three minus two is ..
134. Learner: One
135. Teacher: Two minus four is ..
136. Learner: Two
137. Teacher: So what do we conclude? When you're dividing ..exponents?
138. Learner: Subtract exponents
139. Teacher: Keep in mind your bases as well. You need to keep in mind .. if your bases are the same you ..
140. Learner: Subtract your exponents
141. Teacher: You subtract your exponents when you're dividing. Right? What do we say in multiplication? You add your exponents and you keep your base. Your base must be the same. Keep that in mind. Your base the same .. add exponents when multiplying. Base the same .. subtract exponents when dividing. Right? Do you understand that?
142. Learner: Yes
- 09:00 143. Teacher: Okay. [09:00] I can give you something like ... a unknown variable like a to the power four times b ..to the power two over /teacher does not complete sentence, but completes writing the problem on the board:/ $\frac{a^4.b^2}{a^3.b^1}$ / so what do I do now?
144. Learner: Add the four
145. Teacher: Remember we are dividing a to the power four times b to the power two over .. er .. divided by a to three times b to the power one
146. Learners: Minus the four

147. Teacher: You can't see?
148. Learner: Yes
149. Learner: Miss...(inaudible)
150. Teacher: Wait ... I'll write it in another colour
151. Learner: Miss it's not the colour, Miss
152. Learners: (Inaudible)
153. Teacher: I can't hear what you're saying
154. Learner: Miss, write it there on top
155. Teacher: Where?
156. Learner: It's because the door is open
157. Learner: It's not that
- 10:04 158. Teacher: [10:04] If I write here can you see?
/Teacher rewrites the problem on a different space on the board, where the light doesn't prevent learners from seeing the text./
159. Learner: Yes
160. Another Learner: I can't see.
161. Teacher: Can you see, Imeraam?
162. Learner: Yes
163. Teacher: Okay, what do I do now?
164. Learner: Add the two exponents
165. Teacher: Remember I want to do it that way first
166. Learner: a times a
167. Learner: Four a 's
168. Learners: a times a times a times a
169. Teacher: a times a times a times a . And then it's ...
170. Learners: b times b times b times b
171. Teacher: b times b times b times b
172. Learner: Is that a plus or minus?
173. Teacher: b times b times b . Right? And at the bottom?
174. Learner: a times a
175. Learner: Times b
176. Teacher: And so we do the same thing here. Isn't it?

177. Learner: Yes
178. Teacher: Which is first? We first divide our numerators by our denominators [11:00]
- 11:01 179. Learner: Four minus
180. Teacher: So a divided by a times a divided by a . How many a 's are we left with?
181. Learner: Two
182. Teacher: a to the power two and now b 's. b divided by b and we left with?
183. Learner: Two b 's
184. Learner: b to the power two
185. Teacher: Right. Another way you can do it is by writing a . Remember the rule in dividing. You keep your bases and you subtract your exponents. Right? So, you keep your a and you subtract your exponents minus two times b to the power three minus one. Isn't it?
186. Learner: Yes, Miss
187. Teacher: Right
188. Learner: It's easier
189. Teacher: Okay so a to the power four minus two is?
190. Learner: Two
191. Teacher: Two. Sorry ... And b to the power three minus one is?
192. Learner: Two
193. Teacher: Do we all get that?
194. Learners: Yes.
195. Teacher: You keep your base and you subtract your exponents. [12:00]
196. Learner: Yes
197. Teacher: Right. ... Just hold on. ... Right ... Please be able to see 'cause I've got to...
198. Learner: Write in black, Miss.
199. Learner: Write in black
200. Teacher: Let's use the division rule again or law. What do I do?
201. Learner: The three times three times three
202. Teacher: Okay. / Writes $3^3/3^3 = 3^{3-3}$
 $= 3^0$ /
 Which way do you prefer?
203. Learners: The other [indistinct]

204. Teacher: Okay. Right. Now we can use it that way. [13:00] You keep your base and you subtract your exponents. Isn't it? Right. So three to the power .. sorry three minus three is?
205. Learner: Nought.
206. Learner: Three Miss.
207. Teacher: So what is three to the power zero equal to?
208. Learner: Three.
209. Learner: Zero Miss.
210. Teacher: How do we know that?
211. Learner: 'Cause three divided by zero is zero.
212. Teacher: Okay. What is ... what did you say? Three divided by? No, we don't ..
213. Learner: It's one, Miss
214. Teacher: Okay, no ... it is one .. it is one .. but how do we know that it's one?
215. Learners: [Indistinct]
216. Teacher: Right, this is what we do. Three to the power three over three to the power three. Right? We write it out. /Writes it on the board/ Three multiplied by three multiplied by three over three multiplied by three multiplied by three. Right. So now we cancel ... or we divide in other words
217. Learner: It's not ..
218. Learner: Look ..
219. Teacher: That cancels and that cancels [14:00] and what are we left with?
220. Learners: [Various answers] Nought. Nought. One. Three. One
221. Teacher: No, remember it's one times one times one is?
222. Learner: One
223. Teacher: Over one times one times one is ?
224. Learners: One
225. Teacher: Equals?
226. Learners: One
227. Teacher: One. So now ... Can you all see if I write on this board?
228. Learners: Yes.No. Yes Miss. No Miss.
229. Teacher: If I write another example?
230. Learner: Yes, Miss
231. Learner: No Miss

232. Teacher: Okay ... can I erase and just give you the examples again afterwards?
233. Learner: Yes
234. Learner: Miss, leave that one on.
235. Teacher: Must I leave this one?
236. Learner: Miss, that two. Erase that.
237. Teacher: Can I take this one off?
238. Learner: Yes, Miss
239. Teacher: I need this place. I need that there. Um .. right .. er .. right. Four .. this four to the power ./ Writes $4^4/4^4=4X4X4X4/4X4X4X4$ / raised to the power four. You write four ..
240. Learner: Times four times four times four
241. Teacher: Over
242. Learner: Four times four times four [15:00] times four.
243. Teacher: Right. Now we divide or cancel
244. Learner: Cancel.
245. Teacher: Four and we're left with?
246. Learner: One over one equals one
247. Teacher: One over one equals one So what do we notice? What do we notice?
248. Learner: Four goes into four one times
249. Teacher: Okay. Let me first, ... Equals four to the power four minus one is? Four to the power?
250. Learner: [Various responses] Nought. Nought. Zero. One
251. Teacher: Zero. Right. So four to the power zero equals one in other words. Isn't it?
252. Learner: Yes.
253. Teacher: And three to the power of zero equals one also. Isn't it?
254. Learner: Anything times one [Indistinct]
255. Teacher: So now, anything with an exponent zero is always?
256. Learner: One
257. Teacher: One. Did you get that?
258. Learner: Any number
259. Learners: Yes, Miss
260. Teacher: Right

261. Learner: Shhhh
262. Teacher: ... [16:00] ... Exercise ... you can ... your books are out, ne {right}? Okay. Let me first write the examples down .. or do you want me to number it rather?
263. Learner: Miss
264. Learners: Number it. Number it
- 16:22 265. Teacher: [16:25] Then I'll write it out. /Writes an exercise on the board./
266. [Long pause with quiet activity. Video doesn't show what is taking place. Learners talking. Teacher writes exercise on board]
- 18:28 267. Teacher: What?
268. Learner: Is it a two there?[Not clear from video what is happening?]
269. Teacher: Oh, here? Okay (rest inaudible)
270. Learner: Four
271. Learner: Five
272. Learner: Oh
- 19:24 273. Observer: Can I take your book? I must find the page.
274. Teacher: That's fine
275. Learner: Oh, I understand
276. Learner: Shhhh
277. Learner: Miss here
278. Teacher: Right, I would like to see your work [20:00] tomorrow.
279. Observer: [20:09] Bell go? Just hang on. Keep your book there. Just keep it, hey. ... Thank you. Why did you ... just explain to me what you did in this sum here
280. Learner: Four and four ne {right}, Miss?
281. Observer: Yes, four and four
282. Learner: And then you make it eight. Eight and eight [21:00] ne? {right}, Miss ..
283. Observer: Eight and eight
284. Learner: And then you minus it ne {right} Miss .. and then you get four and nought
285. Observer: Right
286. Learner: And then you get um a ne {right}, Miss
287. Observer: a?
288. Learner: And then you get two and then you minus the two and then you get a one

289. Observer: Okay

290. End of Lesson.

University of Cape Town

Appendix 8

SAMPLE OF CODED MATHEMATICS LESSON TRANSCRIPTS

Key

IQ	Interrogative question
PQ	Pacing question
SCQ	Statement completing question
c	Statement completing response
e	Explanation response
n	No
y	Yes
si	Silent
vr	Varied response
ncb	Non content-based response

NB:

- 'Non content-based responses' were not fully captured in the lesson transcripts, as those kind of responses often came up when the teacher engaged in conversations with learners as s/he moved around the classroom, perhaps to check or mark learners' work (e.g.). Apart from that, some conservation were not within reach of videos (especially the audio part), hence I only considered those that were recognisable in the analysis.
- Only choral responses were categorised as varied and homogeneous responses respectively. Here I coded the varied responses with an assumption that all the responses that differ with them are homogenous. Some of the varied responses were not fully captured in the transcripts; therefore a distinction between varied and homogeneous responses is clearly marked in the video records.

School P1 lesson 1				
1, 2,	Teacher	We said the degree of the polynomial is what? If you're given an example two x plus four x squared minus three x cubed minus four, what would be the degree of this polynomial?	SCQ, SCQ	
	Learners:	Three x cubed. Cubed. Three x .	SCQ	c
	Learners:	X. Three x .		c
3	Teacher	What are you learning?	PQ	

	Learner	Three.		c
4	Teacher	What is the degree of this polynomial?	IQ	
	Learners:	Cubed. Three x cubed.		c
5	Teacher	He says it's three x cubed. Is that correct?	PQ	
	Learners:	[Inaudible]. Yes. It's cubed, sir. X .		c
	Learner	It's four.		c
6	Teacher	Why do you say it's four?	IQ	
	Learners:	The highest. It's the highest, sir		e
7	Teacher	He says it's the highest?	IQ	
	Learners:	No, it's the lowest.		n c
8, 9	Teacher	You were saying it's three. Why?	IQ, SCQ	
	Learners:	The highest. It's the highest.		e
10	Teacher	Where is the three?	IQ	
	Learners:	[Inaudible].		c
11	Teacher	Will you come and show me?	IQ	
	Learner	It's cubed.		e
12	Teacher	That is the three...	SCQ	
	Learner	Cubed.		c
13, 14, 15,	Teacher	Alright? What is the power of this? What is ...	PQ, SCQ, SCQ	
	Learners:	One. One. One sir.		c
16	Teacher	What is the power of four?	SCQ	
	Learners:	Zero.		c
17	Teacher	Is x to the power of zero. Why do you say it's x to the power of zero?	IQ	
	Learners:	Because there's no x .		e
18, 19	Teacher	Yes, what is the other reason? What other way can we find x to the power of zero?	IQ, IQ	
	Learners:	One. It's one.		c
20, 21, 22	Teacher	Now what is the index of the ... the fourth term? What is the index of the fourth term? What is the power of the fourth term?	SCQ, SCQ, SCQ	
	Learners:	Sir, sir. Nought.		c
23, 24	Teacher	Why do you say it's zero? Because we can re-write it as x to the power of zero and we are looking at that. So the power of this x , though it's not reading, we say it's zero. Do we all agree?	IQ, PQ	
	Learner	Yes, sir.		
25	Teacher	Just go over what we did last week and now which of those terms, we've got four terms there, which of those four terms is a constant term?	IQ	
	Learners	One. Four. Four.		c
26, 27, 28,	Teacher	Okay, somebody else with a different opinion? Sampson? ... The gentleman at the back? ... Alright!	SCQ, SCQ, SCQ	
	Learner	Four.		c
29, 30	Teacher	He's saying it's four? Is it four or minus four?	SCQ, SCQ	
	Learner	Minus four, sir.		c
	Learners:	It's four, sir.		c
	Learners:	It's minus four, sir		c
31	Teacher	Why do you say it's minus four?	IQ	
	Learners:	Because the minus is there, sir.		e
32	Teacher	Okay, alright. Do minus you all see it's minus four?	PQ	
	Learner	Yes sir.		

33	Teacher	Why do you say it's minus four?	IQ	
34	Learners:	Because the minus in front.		e
35	Teacher	What is the co-efficient of the second term?	SCQ	
	Learner	Four.		c
	Learner	Plus four.		c
36, 37, 38	Teacher	When it's plus, we can leave it as just a four if we choose to, alright? What should you do? Plus four times two squared minus three times two cubed minus four. Do you all remember this?	PQ, SCQ, PQ	
	Learners	Yes, sir.		y
39, 40	Teacher	Alright, now can we try and find and solve this? What is two times two?	SCQ, SCQ	
		Four.		c
41	Teacher	It's four. So you got a four here. What is two squared?	SCQ	
		Four.		c
42, 43	Teacher	Four. Four times four? It's plus sixteen. It's plus sixteen. Now let us come to this. What is two cubed?	SCQ, SCQ	
	Learners:	Eight.		c
	Learners:	Nine. Nine.		c
44	Teacher	Okay, what does two cubed mean?	SCQ	
	Learner:	It's six.		e
	Learner:	It's eight sir. It's eight. It's three times three. ... Eight. It's eight.		e
45	Teacher	So what is two cubed?	SCQ	
	Learners:	Eight.		c
46, 47	Teacher	Alright, it's eight. Eight times minus three? Eight times three is?	SCQ, SCQ	
	Learner	Twenty-four.		c
	Learner	Eight times three?	SCQ	c
48	Teacher	Okay, eight times minus three therefore is ?	SCQ	
	Learner	It's minus twenty-four.		c
49, 50, 51	Teacher	We are saying you should get four plus sixteen minus twenty-four minus four. What should be the value of this? How do you simplify further? What is four plus sixteen?	SCQ, IQ, SCQ	
	Learner	Twenty.		c
52	Teacher	It's twenty. What is minus four minus twenty-four?	SCQ	
	Learners:	Minus twenty-eight.		c
53	Teacher	Minus twenty-eight. What is twenty minus twenty-eight?	SCQ	
	Learners:	Minus eight.		c
54, 55, 56	Teacher	Are there any people who would like to participate in that competition? You would? One, two, ... three. ... Alright?	PQ, PQ, PQ	
	Learner	Must I write the heading terms, Sir?		ncb
57, 58, 59, 60	Teacher	First one that we're gonna deal with is addition. ... How can you add terms? How do you know that terms are alike? Which one has the same power here? Two a squared is of the same power as?	SCQ, IQ, IQ, SCQ	
	Learners:	Five a squared.		c
61, 62, 63	Teacher	Why do you say they are alike? Because they are having the same power. What about minus three a ? Which term is alike to minus three a ?	IQ, SCQ, SCQ	
	Learners:	A . Minus five a .		c
64	Teacher	It's minus five a .	SCQ	
	Learners:	And minus a , sir.		c
65	Teacher	Just hold on. ... And?	SCQ	
	Learners:	Minus a .		c
66	Teacher	What is a like term to plus five?	SCQ	
	Learners:	Plus two.		c

67	Teacher	It's plus two.	SCQ	
	Learners:	And plus three.		c
68, 69	Teacher	And plus three. ... Alright? Now let us look at these and verify if really they are like terms. Do these have the same power?	PQ, SCQ	
	Learners:	Yes, sir.		
70	Teacher	Yes, the same power is?	SCQ	
	Learners:	Two.		c
71, 72	Teacher	It's two. Alright? Do these have the same power?	PQ, SCQ	
	Learners:	Yes sir.		c
73	Teacher	Yes. What is the power?	IQ	
	Learners:	One.		c
74	Teacher	So the power is one. So these are like terms. What about these?	SCQ	
	Learners:	Yes.		
75	Teacher	What is the power of these terms?	SCQ	
	Learners:	Nought.		c
76, 77	Teacher	That is what we agreed upon, alright? So now we can add them up. What is a minus two and a plus five?	PQ, SCQ	
	Learners:	[Inaudible].		c
78, 79, 80, 81	Teacher	What is an answer to these two terms? What is a plus five and a minus two? What is a minus two and a plus five? I want to see that. What should be the answer to those two terms?	SCQ, SCQ, SCQ, SCQ	
	Learner	Excuse me, sir? [Inaudible].		ncb
82	Teacher	You need to find what this co-efficient is. ... One thing I would like to know from you. What is a minus two plus five?	SCQ	
	Learner	Three.		c
	Learners:	Equals a plus three, sir. [Inaudible].		c
83	Teacher	Are you finished copying?	PQ	
	Learners:	Yes, sir.		
84	Teacher	Because we are speaking of apples, we can only add apples to apples; oranges to oranges. Which means like terms together?	PQ	
	Learner	Yes, sir.		
85	Teacher	I've got minus two apples and plus five apples. What should be the answer of minus two plus five?	SCQ	
	Learners:	Plus three.		c
	Learners:	Three.		c
86	Teacher	What is a minus three, a minus five and a minus one?	SCQ	
	Learner	A minus nine.		c
	Learners:	Minus nine.		c
87, 88	Teacher	Okay. How do we get minus nine? Minus three and minus five is?	SCQ	
	Learners:	Eight.		c
	Learner	Minus eight.		c
89	Teacher	It's minus eight. Minus three and minus five is minus eight. Minus eight minus one is?	SCQ	
	Learner	Minus nine.		c
90, 91	Teacher	Okay? Now let us come to the last bit. ... Let us come to the last bit. What is five plus two?	SCQ	
	Learners:	Seven.		c
92	Teacher	Seven plus three.	SCQ	
	Learners:	Ten.		c
93, 94, 95	Teacher	The vertical method is going to add them downwards in rows, okay? We are saying we got two x plus five and then the second, we've got	PQ, SCQ, SCQ	

		minus x plus three. What should you do? It's two x , what is the like term to that?		
	Learners:	Minus x .		c
96, 97	Teacher	It's minus x . Alright? And then you got plus five. What is the like term to plus five?	PQ, SCQ	
	Learners:	Plus three.		c
98	Teacher	Plus three. Okay, now let us add these. What is minus, what is two x minus x ?	SCQ	
	Learners:	Three.		c
	Learners:	Three x .		c
	Learners:	One x .		c
99	Teacher	What is two minus one?	SCQ	
	Learners:	One x .		c
100	Teacher	What is five plus three?	SCQ	
	Learners:	Eight.		c
101, 102, 103, 104, 105	Teacher	It moves in that direction, okay? Where should the x be? It should be underneath the two. We got there minus x . So like terms are grouped in one row, alright? Where should the plus three be? It should be underneath five and now we can add. What is five plus three?	PQ, SCQ, PQ, SCQ, SCQ	
	Learners:	Eight.		c
106	Teacher	It's eight. It's plus eight. What is two minus one?	SCQ	
	Learners:	One.		c
107, 108, 109, 110	Teacher	What are you doing? Why to the power two? Y and x squared, alright? Now can you try the vertical method?	SCQ, IQ, PQ, IQ	
	Learners:	Will sir come check mine please, sir?		ncb
111	Teacher	Yes, I'm coming. Move with the row please. ... So these are like terms here. Where's your what? [Inaudible].	SCQ	
	Learner	[Inaudible].		ncb
112	Teacher	Minus two x . Only like terms. Can you do that whole term?	SCQ	
	Learners:	Yes		
113, 114, 115, 116	Teacher	Can you do the vertical method only? Do it here? Can you do the vertical method only? Before you go, can I have a look at your books?	PQ, PQ, PQ, IQ	
	Learners:	Sir, is the vertical method correct?		
117	Teacher	That's correct?	PQ	
	Learners:	Yeah!		
	Learners:	Sir!		ncb
118	Teacher	I'm coming to you. I'm on my way. ... Alright. Vertical?	PQ	
	Learner	The bottom one, sir.		ncb
119, 120	Teacher	What is the answer here? Write the terms down. X squared plus four x . What is this and that? [Inaudible] ... minus two. [Inaudible].	PQ, IQ,	

School P1 lesson 2				
	Question	Type	Learner response	Type
1	We are still busy with exponents as we did last week. Alright?	PQ	Learner: Yes, sir.	y
2	Because some of the questions that came from that are things that we have not yet done in class and I said I'm going to explain them. Alright?	PQ		
3	Law number one, you say that if you have a to the m times	IQ	Learner: A plus m .	e

	a to the n . What answer do you think we should get?		Another Learner: A and m plus .	e
4	Teacher: It's a , the same base, m .	SCQ	Learners and Teacher: Plus n .	c
5	Teacher: That's what we said, isn't it?	PQ	Learner: Yes sir.	y
6	And you add up your exponents to find the sum of that which is minus four plus two. That's what we said, isn't it?	PQ	Learners: Seven	c
7	What is minus four plus two?	SCQ	Learners: Minus two.	c
8	It's minus two. That's what I want, okay?	SCQ		
9	How do we get that?	IQ		
10	What do you think should be the answer?	IQ	Learners: X minus ... x ... x .	e
11	It's x , the same base, you keep the base, it's ...	SCQ	Learners: Minus b plus one.	c
12	That is how we did it. In this one it looks in the classical division way. What should we do? It's a , we keep the base again.	SCQ	Learners: m minus n .	c
13	It's m ...	SCQ	Learners: Minus n	c
14	... minus n which means we take the difference. Alright?	PQ		
15	I say two to the power of four divided by two to the power of one. Okay, two divided by one. Okay. What should be the answer?	SCQ	Learners: Two and four minus one.	e
16	Minus one and the final answer is?	SCQ	Learners: Two to the power of three.	c
17	I say, I've got three to the power of seven, divided by three to the power of eleven. What should be the answer?	SCQ	Learner: Three over minus four. Another Learner: Three to the power of minus four.	e e
18	It is three to the power of seven?	SCQ	Learners: Minus eleven.	c
19	What if my denominator was negative?	IQ		
20	What would I do if it was negative?	IQ		
21	What would I do if it was negative?	IQ		
22	Is there anybody who's quite confident now?	PQ		
23	It's x four	SCQ	Learner: x four minus three.	c
24	Minus...	SCQ	Three	c
			Minus, minus three	c
25, 26	The denominator is supposed to be negative. Alright? So what should we do now? It's x four	PQ, IQ	Four	c
26	What is a negative times a negative?	SCQ	Plus three ... plus	c
27, 28, 29	What should you do? What do you do to your powers? You multiply your powers. Can you take this down please guys?	IQ, IQ, PQ	We have that down. ... we have that down	e
28	So if we have three to the power of four, to the power of five. What should be the answer there?	IQ	Three ... [inaudible] it's four times five ... [inaudible] to the power of ...	e
29	What if I had two to the power of two and all to the power of a half. What should be the answer there?	IQ	Two.	c
30	What is two times a half?	SCQ	One	c
31	Are we happy about this?	PQ	Yes, sir	y
32	I've got x to the power of y times zed. What should be my	SCQ	It's x	c

	answer?			
33	You come to class without a pen?	PQ		
34	If there's no power indicated to you, class, what power is there?	SCQ	One.	
35	What is the power of x ?	SCQ	[Inaudible]	c
36, 37, 38	What is the power of y ? What is the power of m ? (Word unsure). What is one times seven?	SCQ, SCQ, SCQ	: [Inaudible]	c
39	You see, most of you, what are you doing? They are copying one to four and you leave them blank.	PQ		
40, 41	What is three to the power of three? Three times three times three. What is it?	SCQ, SCQ		
42	Yes. It's a half to the power of?	SCQ	Three.	c
43, 44	What is three to the power of eight? [Inaudible]. What is two to the power of two?	SCQ, SCQ	two times two	c
45, 46, 47, 48, 49, 50, 51,	What is three to the power of four? Three times three times three times three? What does three to the power of three mean? What is three times three times three? Three times three is what? Nine times three is? Nine times three?	SCQ, IQ, SCQ, SCQ, SCQ, SCQ, SCQ	Twenty-seven	c
52	Twenty-seven. So three to the power of three is?	SCQ		
53,54,55,56	Let's start from scratch. It's x to the power of? Y to the power of? And zed to the power of one. Why do we say that? What is x , one times seven?	SCQ, SCQ, IQ, SCQ	X , seven	c
57,58	One times seven? One times seven?	SCQ, SCQ		
59	Was that difficult?	PQ		
60	What should you do?	IQ		
61, 62, 63, 64, 65,	What does this mean? One times three? What is one times three? What is two times three? What is three to the power three?	IQ, SCQ, SCQ, SCQ		
66	Is that difficult?	PQ	No sir.	n
67	According to this, we know that if there's nothing that reads, all the powers are?	SCQ	One	c
68	we can start applying law number three. It says, if you've got a power and another power; what should you do to the powers?	IQ	Times it.	c
69	Do you all agree?	PQ	Yes, sir.	y
70	Which is, one times seven is?	SCQ	Seven	
71	Now let's come to the next one. ... Thompson, what should we do?	IQ	Sir, we should plus the powers [inaudible] so it's gonna be, three to the power one times three.	e
72	What is three to the power of three?	SCQ	Twenty times [inaudible].	c
73, 74, 75	We're gonna help you but you're gonna iPQtiat. Can you help us? Okay? Just the interpretation of that question we're asking for. What should we do?	IQ, SCQ, IQ	A half, sir.	c
76	Huh?	SCQ	One half.	c
77, 78,79, 80	I'm lost? Tell me? ... Yes? We've done this one, we've done that one. Daniel, over to you. ... We've done this one we've done that one. Yes?	IQ, IQ, SCQ, PQ	[inaudible].	e

81	What is one times two?	SCQ	Two.	c
82, 83, 84, 85	Are we clear about that? Because that is the important thing that we're doing. Is that clear? That is the important thing. Okay? Now let us move on. What is one to the power of two?	PQ, PQ, PQ, SCQ	One.	c
86	Anybody who is willing to help us?	PQ	Minus three	c
87	What should you get here?	IQ		
88, 89, 90	What is negative three to the power of three? Somebody else would like to try this? ... He says twenty-seven. Is he right?	SCQ, SCQ, PQ	Yes. .. [inaudible] No .. It's minus twenty-seven	y n e
91	Why do we get minus twenty-seven?	IQ	three times three ... three times ...	c
92, 93	Why are we not getting positive twenty-seven? Why are we not getting 100?	IQ, IQ		
94	Why are we not getting positive twenty-seven?	IQ		
95	We have said, it means it's minus three times minus three. How many times?	AQ	Three times.	c
96	What is minus three times minus three?	SCQ		
97	What's a negative times a negative?	SCQ	Nine. Nine. A positive nine	c
98	What's a positive nine times a negative?	SCQ	A negative. A negative twenty-seven.	c
99	What is a negative times a negative?	SCQ	: A positive.	c
100	What is a positive times a negative?	SCQ	: A negative.	c
101, 102, 103	What have you got? Let us add those to our questions. What would you do if you had a negative power? ... What would you do if you had a negative power?	SCQ, IQ, IQ	Learners: Plus sign,	c
104	Okay, let's get back to the basics. What does the rule say?	IQ	Learners: Plus minus, sir,	c
105	What does the rule say?	IQ	Learners: X times,	c
106	What does the rule say?	IQ	Learners: [Inaudible].	c
107	What does the rule say? If you've got a power over another power, what should you do?	IQ, IQ	Learners: Times.	
108	Multiply. So what should you do?	IQ	Learners: Multiply.	
109	Multiply, so what are we gonna get?	IQ	Learners: X. Others: Plus. Others: Minus one plus two Others: Minus one times two, sir.	c c
110	What is minus one plus two?	SCQ	Learners: Minus two.	C
111	What should we do again?	IQ	Learners: Multiply.	c
112	The important thing is, if you've got a power over another power, what do you do to the powers?	SCQ	Learners: Multiply	c
113, 114	Why? What is it about?	IQ, IQ	Learners: [Inaudible].	c

115	Give me a few of the examples that had the power of zero from the computer. ... Okay?	SCQ	Learner: F to the power of zero	c
116	F to the power of zero?	SCQ	Learners: Equals one.	c
117	Okay. Another one?	SCQ	Learner: Y to the power of zero.	c
118	Y to the power of zero	SCQ	Learners: Equals one.	c
119	Okay, a different one?	SCQ	Learner: X to the power of zero, sir	c
120	D is? ... D divided by?	SCQ	Learner: Brackets, divided by m .	c
121	D divided by?	SCQ	Learner: M ... to the power of nought.	c
122	It seems like it's right as well. ... Okay. Can I get more examples?	SCQ	Learner: M squared. Another: One hundred and seventeen.	C c
123	It's three x , y squared, all to the power of zero. Okay. From the computer we know these are already one, what should be the answer to this one?	SCQ	Learners: One	c
124	: Why should it be one?	IQ	Learners: A over one, sir. A over one	e
125	It's a over one. Why should it be a over one? What is y to the power of zero?	IQ, SCQ	Learners: One.	c
126	It's one and therefore this a divided by one is? A divided by one is?	SCQ, SCQ	Learners: A .	c
127, 128	So the answer should be? A . Or you can write it as a over one or eight. Fine. Are we happy with that? What is one hundred and seventeen to the power of zero?	SCQ, PQ, SCQ	Learners: Nought	
129, 130, 131, 132, 133, 134	Why should it be one? One hundred and seventeen to the power of zero is one. Is that true? ... Why is it true? Why should we say this is to the power of, why should it be one? You're gonna do the proof of that next year. Okay? Alright? What should be the solution to this one?	IQ, PQ, IQ, IQ, PQ, PQ, SCQ	Learners: Two x squared, one	c
135	What is two times one?	SCQ	Learners: Two.	c
136, 137, 138, 139	Two times x squared times one is? Two x squared, alright? Now let us come to this one. ... What do you think should be the solution? What should be the solution here?	SCQ, PQ, SCQ, SCQ	Learners: One over one.	c
140	It's one over one, yes?	SCQ	Learners: Equals one	c
141	Which is one, okay?	PQ	Learners: It's three x squared, it's one.	c
142, 143	Huh? It's one. Why do you say the answer is one here?	IQ	Learners: Because it's nought to the power.	e
144, 145, 146, 147, 148	Guys, can you copy all of these questions? Do you remember the one that we've just done? That's what law number four says but what if you applied law three? Will you still arrive at the answer? ... Will you still?	PQ, PQ, IQ, IQ, IQ	learners	s

149	... Where are your questions?	PQ		
150, 152, 155	Where are the rules questions? And you sit here, don't you know?	PQ, PQ	learner	s

University of Cape Town

School P2 Lesson 1			
1, 2	Teacher: .. the multiplication. Nê? {Right?} Any problems about yesterday's one?	PQ, PQ	
	Learners: No.		n
3, 4	Teacher: Any problems about yesterday's one? The multiplication?	PQ	
	Learners: No problem.		n
5, 6	Teacher: If you still remember yesterday, what we did? .. we said when we are doing multiplication, you add your ...?	PQ, SCQ	c
	Learners: Exponents.		c
7	Teacher: Then in division now we subtract ... the opposite multiplication we	SCQ	
	Learners: .. add		c
8	Teacher: ... and division you ..	SCQ	
	Learner: .. subtract		c
9	Teacher: Yesterday what I told you is that if the number does not have an index or an exponent you must know its always	SCQ	
	Learner: One		c
10	Teacher: Nê? {Right?}.	PQ	
	Learners: Yes		y
11	Teacher: So for us to know, you subtract your ...	SCQ	
	Learners: exponents		c
12	Teacher: <u>andithi?</u> {right?}	PQ	
	Learners: Yes.		y
13	Teacher: So here, how many sevens do we have?	SCQ	c
	Learners: Two ... three.		c
14	Teacher: It's seven, seven, seven .. then you divide by how many sevens?	SCQ	
	Learners: Two		c
15	Teacher: Then what you do, you cancel seven and seven. Nê? {Right?}	PQ	
	Learners: Yes.		y
16,17	Teacher: Then seven <u>no</u> {and} seven. Then <u>lo ushiyekileyo uzakuba yintoni?</u> {what happens to the seven that is left?}. So the one that you do not cancel is your ...?	IQ, SCQ	
	Learner: Answer.		c
18	Teacher: So how many seven <u>ezishiyekileyo?</u> {that is left}	SCQ	
	Learners: One		c
19	Teacher: Then the answer is?	SCQ	
	Learners: Seven		c
	Teacher: Power ...?	SCQ	

Learners: One		c
Teacher: Because, if you subtract three from two, <u>ufumana bani?</u> {what do you get?}	SCQ	
Learners: One		c
Teachers: So <u>uyabona yinto enye le yana?</u> {you see it is the same thing?}. Seven to the power ...?	PQ, SCQ	
Learners: One		c
Teacher: <u>Uyabona?</u> {Can you see?}	PQ	
Learners: Yes		y
Teacher: So it is like seven ... You take seven as your common what ...? Seven is your common ...? Yesterday we said we have two sevens, so seven is your common ...	SCQ, SCQ, SCQ	
Learners: Base		c
Teacher: Seven is your common base and then <u>uthi</u> {you say} three, you subtract your exponents three minus two <u>ngolohlobo</u> {in that way} Niyakwazi?	PQ	
Learners: Yes		y
Teacher: Then <u>kushiyeke bani</u> {what is left?} Seven then three minus two is ...?	SCQ	
Learners: One		c
Learners: Five. [Learner continues on the board.]		e
Teacher: <u>U-cancelisha nabani</u> {What are you cancelling?} <u>Uli-cancelisha nabani eli inani?</u> {With what number are you cancelling this one?}. Come! <u>Ngubani ofuna ukumnceda?</u> {Who wants to help him/her?} <u>U-righthi?</u> {Is he/she right?} <u>U-righthi apha kwesi i-step?</u> {Is she/he correct on this step?}	PQ, PQ, PQ, PQ, PQ	
Learners: No		n
Teacher: What is it that is wrong? What is it that is not right from this step? What is wrong from there? [pointing to the board].	IQ, IQ, IQ,	
Learner: Sorry Miss. This statement must not be here, it must be here		e
Teacher: Do we have something left from <u>kwi-numerator</u> {from the numerator?} If you look carefully from here, she is right from this side, but from that side she is wrong because there is nothing left from the numerator everything is been cancelled <u>andithi?</u> {right?}	PQ, PQ	
Learners: Yes		y
Teacher: It is not two, and how many eights <u>kwi-denominator shiyekileyo?</u> {from the denominator that is left?}. Uyabona? {Can you see?}. So <u>le point uyiphosile</u> {she missed this point} <u>niya-understanda bethunana?</u> {do you understand people?}	SCQ, PQ, PQ	
Learners: Yes		y
Teacher: So if there is nothing left from i-numerator {from the numerator} just write one and then <u>i-denominator</u> {denominator} you count how many numbers that are left, Ok?!	PQ	
Learners: Yes		y
Teacher: <u>Uyabona ke?</u> {Can you see?}	PQ	

Learners: Yes		y
Teacher: And then to change it positive exponent into a negative exponent, you write eight to the power minus ..	SCQ	
Learners: Two		c
Teacher: Alright? .. [some isi-Xhosa speech her]	PQ	
Teacher: Is she right? Is she right?	PQ, PQ	
Learners: No		n
Teacher: Five into two, five into two, how many fives? How many fives? <u>I-answer yakhe</u> {the answer} is five into two. How many fives?	PQ, PQ, PQ	
Learners: Two		c
Teacher: How many fives? How many fives? [Teacher raises her voice.] [Says to the class] I am not asking her [referring to the learner who had worked on the board] <u>Bangaphi aba-five ababhale pha?</u> {How many fives did she write on the board?}	PQ, PQ, PQ	
Learners: Two		c
Teacher: Ok! Lets multiply, five times five is. Five times five is ..?	SCQ	
Learner: Twenty-five		c
Teacher: Is she right?	PQ	
Learner: No		n
Teacher: What is wrong? <u>Jonga i-mistake yakho pha</u> {look at your mistake there}. What is wrong from the answer? .. What is wrong there? ... What is wrong? What is wrong from the answer? Do you understand? Do you understand what is happening here? No. The division?	IQ, IQ, IQ, PQ, IQ, PQ	
Learner: I don't understand.		c
Teacher: You don't understand? Is there anyone <u>bethunana</u> {people} who is lost about today's topic? Is there anyone who is having this problem and not following me? Do you understand? What is wrong there if you follow me? What is wrong here? <u>Uzibonile u-wrongo phi?</u> {Did you see where you went wrong?} ... How many two's are there?	PQ, PQ, PQ, IQ, IQ, PQ	
Learners: Five		c
Teacher: <u>So izakuba ngu-two to what?</u> {So it is going to be two to what?}	SCQ	
Learners: Five		c
Teacher: Do you understand now?	PQ	
Learners: Yes		y
Teacher: <u>Oo-y bangaphi?</u> {How many y's?}. <u>Bayi-ten</u> {There are ten}. {sixty would be a factor of twenty-four}. How many six <u>ezenza u-twenty-four?</u> {that make twenty-four?}.	SCQ, SCQ	
Learner: Four		c
Teacher: <u>Kule-case siza-kuthi</u> {In this case we going to say} twenty-four, how many y's? <u>bayi-ten</u> {there are ten} divide by six y, <u>uyayibona?</u> {can you see it?}	SCQ, PQ	
Learner: Yes		y

Teacher: And then, is six a factor of twenty four? So <u>u-six uya kangaphi kutwenty-four?</u> {Six goes into twenty-four how many times?}	SCQ, SCQ	
Learners: Four		c
Teacher: Four times, <u>uyayibona lo nto?</u> {can you see that?}. We don't have a common base whereby <u>kwi-numerator</u> {from the numerator} we've got two <u>nakwi-denominator</u> {from the denominator}, we've got different factors now, right?	PQ, PQ	
Learners: Yes		y
Teacher: Nê {Right} {translation needed} now we are left with four and how many y's?	PQ, SCQ	
Learners: Nine. Then its four y to the power of nine, then its your answer.		e
Learner: Its easy like this		ncb
Teacher: Is it easy?	PQ	
Learner: Yes		y
Teacher: <u>Calu-calula intsho into.</u> {Simplify, it says so} <u>Baphi abanye abantu?</u> {Where are the other learners?} Do you want to come and try? <u>Umntu makaze azobhala ebhodini bethuna.</u> {Come and make mistakes on the board people}. <u>Andifuni kuze abantu abanye kaloku</u> {I don't want the same people all the time} Simplify.	PQ, PQ	
[Learner does the problem on the board]		e
Teacher: Are we fine?	PQ	
Learner: Yes.		y

School P2 Lesson 2		
Teacher: ... written in power notation and then written using the same base. <u>Uyabona?</u> {You see?} <u>So xa uyiyenza wena uzoyiyenza ibe ngutwo to the power of 3 divided by two niyabona?</u> {They have given you the long method and they say that you should make it a short method then show it in an equation with the same base. So when you do the sum you will make it two to the power 3 divided by two, you see?} [Teacher writes $\frac{2 \cdot 2 \cdot 2}{2}$ on the board.]	PQ, PQ, PQ,	
Learner: Yes miss.		y
Teacher: <u>Because kwenzeka lanto to the power of 3 divided by two and then yidivision lena, niyayazi idivision?</u> {Because this happens to the power of 3 divided by two and this is division, you do know division?} <u>kuthi</u> {that} when the base are the same you cancel the exponent <u>nhe?</u> {right?} and then <u>yangu two</u> {it became two}, two is the common base and then <u>yangu 3</u> {it became 3} <u>ipower apa ngubani?</u> {what is the power here?}	SCQ, PQ, SCQ	
Learners: <u>Ngu one</u> {It is one}		c
Teacher: <u>Akabhalwa ke but kuthiwa minus one ukuthiwa ifumana ngutwo to the power of two ke, niyabona?</u> {You do not write it but they say minus one. they say the answer is two to the power of two, you see?}	PQ	
Learners: Yes madam		y
Teacher: <u>Lamzekelo?</u> {That example?} and then ke the rest <u>izokwenziwa nini.</u> {and then the rest will be done by you.} and the B, number B <u>ebhodini.</u> {on the board}, number B, two two two two <u>bangaphi na o two ?</u> {how many twos are there?}	PQ, SCQ	

Learner: <u>Bayi 3</u>	SCQ	c
Teacher: Divide by two two <u>Izobangubani?</u> {What is it going to be?}		
Teacher: What is the next step?	IQ	
Learners: [Mumbled, inaudible speech]		c
Teacher: <u>Hayi wonke umntu uyathethe ngoku apha eklasini akukho mntu ungathethiyo. Ithini I next step?</u> {Oh so now every one in class has something to say, what is the next step?} <u>wonke umntu makathethe. uyawubona umzekelo wenziwe njani pha? so ke yonke lanto yenzeka ngolahlobo ndiyiyenze ngalo.</u> {Everyone must talk, you see how I did that example? So then everything happens the way I did it.}	IQ, PQ	
Learners: two to the power of 3 divided by two to the power of two.		c
Teacher: <u>Nithe ngubani?</u> {What did you say is the answer?}	SCQ	
Learners: two to the power of 3 divided by two to the power of two.		c
Teacher: <u>Njani?</u> {How so?}	IQ	
Learners: two to the power of one		e
Teacher: Hmmm?	SCQ	
Learners: two to the power of one divided by two		e
Teacher: two to the ...?	SCQ	
Learners: Power one		c
Teacher: Two into four. Okay, then?	SCQ	
Learners: Two to the power of negative one .. two to the power one		c
Teacher: This is the last activity <u>ke bethuna</u> {people} from combination of multiplication and division <u>niyayibona lonto?</u> {do you see that?}	PQ	
Learners: Yes		y
Teacher: <u>Mayibonakale into oyibhala ebhodini</u> {We must be able to see what you are writing on the board}, <u>yintoni le uyibhalayo?</u> {what are you writing?}. [Learner writes $\frac{33333}{33}$ on the chalkboard.]	PQ	
Teacher: <u>Ithini le.</u> {Explain this one.}	IQ	
Learners: Three to the power of five divided by three to the power of two Three to the power of three .. Three to the power of three [Learners applaud the correct answer.]		e
Teacher: <u>Ngubani lo umenzayo wena?</u> {Which number are you doing?}	PQ	
Learners: <u>Ngu F</u> {translation needed}. [Learner writes $\frac{555}{5}$ on the chalkboard.] Five to the power of three.		e
Teacher: <u>Akasoze aphinde avume</u> {He will never agree again}, <u>umntu osebhodini</u> {the person on the board} don't talk. <u>Iright?</u> {Is this right?}	PQ	
Learner: Ha-ah ... <u>Khupha unegative.</u> {Take out the negative sign}		e
Teacher: <u>Why eright u-negative two?</u> {Why is negative two right?}	IQ	
Learner: <u>Andiva miss</u> {Can't hear you miss}		n

Teacher: <u>Why eright u-negative two?</u> {Why is negative two right?}	IQ	
Learner: <u>Kaloku bendi-subtracte u one</u> {Thing is I subtracted one}		e
Teacher: This is the last one, <u>ngunumber bani eyokugqhibela?</u> {what number is the last one?}	PQ	
Learner: H, H		n
Teacher: The next one must do number I and M, the next two we will do I and M. Nê? {Right?}	PQ	
Teacher: <u>Uneproblem?</u> {Do you have a problem?} <u>How many 4's ezilapho eleft?</u> {How many 4's are there on the left?} <u>Cancelisha ke ngoku.</u> {Cancel the others now} How many 4's left? <u>Kushiyeke abangahi kengoku?</u> {How many are left now?}	PQ, SCQ, SCQ, SCQ	
Learners: <u>Bayi 4</u> {There's 4}		c
Teacher: <u>That is because ubhale u4 apha and bangaphi aba 4 balapha?</u>	SCQ	
Learners: <u>Bayi two</u> {There's 2}		c
Teacher: <u>Hayibo!</u> {No ways!} How many tens, <u>nah?</u> {translation needed} Number M, Number M.	SCQ	
Learner: I, I, I		s
Teacher: <u>Kanti nikunumber bani na nina? Ngu L?</u>	PQ, PQ	
Learner: <u>Ku I</u>		s
Teacher: <u>Ngubani emva ko K?</u> {What's after K?} <u>Ngu L?</u> {It's L} <u>Ngu L and M</u> {It's L and M}. <u>Uzokwenza eyiphi nkwenkwe?</u> {Which one are you in to do, boy?}	PQ, PQ, PQ	
Learner: <u>L no M</u> {L and M}		c
Teacher: <u>Yes, nokuba wenza u L nokuba u M, ndifuna ibenye.</u> {Yes, you can either do L or M, I just want one.} <u>Bona ukuba uzokwenza eyiphi?</u> {See which one you can do?}	PQ	
Teacher: <u>Uright?</u> {Is he right?}	PQ	
Learners: No miss!!		n
Teacher: <u>Uwrongo phi?</u> {Where is he wrong?}	IQ	
Learner: <u>Iright but miss apha ekugqhibeleni funeka amelanga uyifake ...</u> {It is right but at the end he was not suppose to put ...}		c
Teacher: <u>Ungayi simplifier ke but still nokuba uyishiyile injevana iright because kuthiwa apha encwadini niyevani?</u> {You can still simplify it, even if you leave it like that it is still correct, that is what the textbook says. Do you hear?}	PQ	
Learners: Yes.		y
Teacher: Right, <u>u4 basically is the same so it's 3 into 4 minus 4 that is why eno 3 into 0 niyabona?</u> {4 basically is the same, so three to four minus four is why he has three into zero, you see?}	PQ	
Learner: Yes.		y
Teacher: <u>Ngeyiphi ibase?</u> {Which one is the base?} <u>Nokuba ubunokumbuza akayazi ibase.</u> {Even if you would ask him he does not know what the base is.}	SCQ	
Learner: <u>Ibase miss, ngu 10</u> {The base miss is ten}		c
Teacher: <u>Ibase ngu 10</u> {The base is ten}, then?	SCQ	

Learner: <u>I-exponent ibe ngu4 ... ngu 0.</u> {The exponent is four ... zero} [Learner at the board changes his answer to 10^0 .]		c
Teacher: <u>Uyabuza lona njani?</u>	SCQ	
Learner: <u>Xolo miss akushiyeke nto xa ulantuka?</u> {Excuse me miss, there is nothing left when you} ... <u>xa ukhanselisha.</u> {when you cancel.}		c
Teacher: Multiplication, if you are multiplying you know the rule when the base are the same. What is the rule of multiplication with exponent? ... [The learner at the board still struggling to write down the next problem - he writes $3^4 \times 3 - 2 \times 3$. This takes about one and a half minutes. The teacher eventually corrects this to $3^4 \times 3^2 \times 3$.]	IQ	
Teacher: Multiplication, what is the rule for multiplication when you are multiplying exponent? .. Hmmm?	SCQ, SCQ	
Learners: [Mumbled speech]		e
Teacher: And then 3 and then 4 minus two and here? .. Hmmm?	SCQ, SCQ	
Learners: Plus one		c
Teacher: <u>He bethuna! then ngubani i-answer? Abantu ngoku abayazi kodwa siqale ngayo imultiplication.</u> {People now do not know but we started with multiplication}	SCQ	
Learner: Three to one		c
Teacher: <u>Nenze njani?</u> {How did you do it?} 4 minus two?	IQ, SCQ	
Learners: Two		
Teacher: Then it's three nê? {right?} into three. Then what is three into three? What is three into three? If you are changing this into a number...if you are changing it into a number ngubani?	PQ, SCQ, SCQ	
Learners: <u>Ngu one</u>		c
Teacher: <u>Bangaphi aba 3?</u> {How many three's are here?}	SCQ,	
Learner: <u>Ngu twenty seven miss.</u> {It's twenty seven miss.}		c
Teacher: <u>Yho!</u> {Pheew!} number? <u>Bendithe ngu number bani lento?</u> {What number did I say this is?}	SCQ, SCQ	
Learners: E		n
Teacher: <u>So izakuba ngubani i-answer pha?</u> {So what is the answer there?}	SCQ	
Learners: Five		c
Teacher: Hmmm?	SCQ	
Learners: Three to the power of five.		c
Teachers: <u>Uyekwelandelayo ngaphayana.</u> {Go to the next one on that side} and then <u>kuleyana ngubani?</u> {what is that one?}	SCQ	
[Learner continues to write on the board with the help of other students.]		e
Teacher: <u>Umfumene njani uPlus five?</u> {how did you get plus five?} <u>lo plus five umfumene njani?</u> {how did you get this plus five} This one is division and this one is ..?	IQ, IQ, SCQ	
Learners: Multiplication		c
Teacher: So where do you get the positive five? Because it say it's positive. Five is having	IQ, PQ,	

negative. Nê. {Right?} Hmmm? This is multiplication, this side is multiply, this one is division so the rules are not the same. You know the rule of multiplication and you know the rule of <u>intoni</u> ? {what?}	SCQ, SCQ	
Learners: Division		c
Teacher: So where do you get to this part? <u>Nonke nithe ngu five nimyekile njena</u> . {You all said five and let him write five}	IQ	

School P2 Lesson 2		
Teacher: <u>U-b to the power two uzoba phezulu?</u> {Is <i>b</i> to the power two going to be on top?}. <u>Ayi-ngo over?</u> {Is it not over?}. So <i>b</i> stays that way?	SCQ, SCQ, PQ	
Learners: Yes		y
Teacher: Any problems from that one? {pointing to the board}	PQ	
Learner: No problems. [One learner says /problemo/]		n
Teacher: do you understand? do you understand? Go to the board and write the next one .. if you do understand.	PQ, PQ, IQ	
Teacher: Number two, .. six ... six to the power of four divide by six to the power of eight, iphelele apha? {is that the whole sum?}	SCQ	
Teacher: Ok ? ..	PQ	
Learners: Yes		y
Teacher: <u>U-right?</u> {Is she right?}	PQ	
Learner: Yes		y
Teacher: Yesterday I told you that <u>xa injena</u> {when it is like this} .. <u>kwi-negative form andithi?</u> {in a negative form right?}	PQ	
Learners: Yes		y
Teacher: Then when you change it into a positive form you must write it one over six to the power of four. How many six left?	SCQ	
Learners: Four, four		c
Teacher: How many six left?	SCQ	
Learners: Four.		c
Teacher: One, two, three, four <u>andithu?</u> { right?} Six that are left .. <u>zintoni?</u> {what are they?} <u>Zi-under i-denominator</u> {they below the denominator}. That's why <u>i-exponent in-negative sign, nhe?</u> {the exponent has a negative sign, right?}, but <u>kwi-numerator</u> {from the numerator} we only have one, {Some missing speech and translation } we cancel everything <u>kwi-numerator</u> {from the numerator}, so we are left with <u>bani?</u> {what?} One, and than <u>i-denominator yethu sinabani?</u> {what do we have as our denominator?} How many six left?	SCQ, SCQ, PQ, PQ, SCQ, SCQ, SCQ	
Learners & teacher: Four		c
Teacher: Number three is three to the power of nine divide by three to the power four, qha?! {only?!}	PQ	
Learners: Yes		y
Teacher: What is the answer? .. Who did not do the homework? Who didn't finish the homework? Ok, first, who didn't do the homework? Why? [pointing to a learner]	SCQ, PQ, PQ, IQ, IQ	s

Why you didn't do your homework?		
Teacher: You won't understand maths if you don't attempt it by practising it, ok?!	PQ	
Learners: Yes		y
Teacher: <u>Ngubani omnye?</u> {Who else?!} Who didn't finish homework? Why?	PQ, IQ, IQ,	s
Teacher: <u>Wena?!</u> {And you?!} [pointing to the learner].	PQ	s
Teacher: <u>Azukuphinda yenzeke lo nto leyo, ok?!</u> {That will never happen again, ok?!}		
Learner: Yes		y
Teacher: If you didn't follow me, don't let me go without informing me that <u>xolo miss</u> {sorry teacher} I didn't understand this one. Come and make an appointment with you, ok?!	PQ	
Learners: Yes miss		y
Teacher: Because now I cannot move to from scratch another step if <u>kukho abantu abangakhange bandi-understande</u> {if there are people who did not understand me}, ok?!	PQ	
Learners: Yes		y
Teacher: We did <u>i-multiplication mos?</u> {right?!} First we started with multiplication, nhe? {right?} and yesterday we did division, ok! And what I told you that any .. base .. with a zero .. exponent, you know the answer is always ...?	PQ, SCQ	
Learner: One		c
Teacher: If we are having five to the power two divide by five to the power four. This one now I don't want to use this method, ok?! [points to $\frac{5.5.5.5}{5.5.5.5.5.5.5.5}$]	PQ	
Learners: Yes		y
Teacher: This is five to the power two, <u>ii-base</u> {the base} are the same <u>andithi?</u> {right?}	PQ	
Learners: Yes		y
Teacher: Yesterday we said, if we are doing <u>i-division</u> {division} you subtract the ...?	SCQ	
Learners: Base		c
Teacher: The what?	SCQ	
Learners: The base		c
Teacher: You subtract what?	SCQ	
Learner: The base		c
Teacher: So it's five, you take five as your common base and then you just subtract your exponent. Uyayibona? {Can you see that?}		
Learners: Yes	PQ	
Teacher: So five is a base and five is a base so therefore five is your common base and then you subtract your ...?	SCQ	
Learners: Exponent		c
Teacher: Then <u>izakuba ngubani i-answer?</u> {what would the answer be?}	SCQ	
Learner: Five to the power four negative four		c
Teacher: Two minus four, apply your sign rules .. Two minus four? {pointing to a learner}	SCQ	

Learner: Five to the power negative two		c
Teacher: Two is positive, two is positive minus four, addition sign? Addition sign you know the signs, <u>nanitsho niyazazi i-signs</u> {you said yourselves that you know the signs} So these exponents <u>ikweyiphi i-format?</u> {are in which format?} It's a negative exponent and when you are changing it into a positive ... <u>itsho mos i-question</u> {the question says so right?}, give all the answers with positive exponents, <u>siyayibona?</u> {can we see that?}	SCQ, SCQ, PQ, PQ	
Learners: Yes		y
Teacher: So if your answer is like this five to the negative two, it means you didn't follow the question, your answer must be in a positive exponent, then we are changing it into a positive exponent <u>izakuba ngubani?</u> {what will the answer be?} If we are changing the negative exponent into a positive exponent, what is it now?	SCQ, SCQ	
Learner: One over five ..		c
Teacher: One over ..	SCQ	
Learner: Five to the power two.		c
Teacher: What is the law any number with a zero exponent? What is your answer?	SCQ, SCQ	
Learner: [Three learners, in succession, say /one/]		c
Teacher: So is she right?	PQ	
Learners: Yes		y
Teacher: Seven into three, nhe? {right?} Divide by seven into zero, <u>ngubani?</u>	PQ, SCQ	
Teacher: So <u>si-divida ngabani?</u> {what do we divide by?} Any number with a zero exponent? [Teacher raises her voice] What is the answer? What is the answer for this? [pointing at 7^0]	SCQ, SCQ, SCQ, SCQ	
Learner: One		c
Teacher:] [writes $7^3 + 1$ on the b Any number with a zero is always .. ?	SCQ	
Learners: One		c
Teacher: <u>Ngubani omnye une-answer?</u> {Anyone else who has an answer?} Who knows the answer?	PQ, PQ	
Teacher: Five divide by one?	SCQ	
Teacher: Seven into three divide by seven into zero [writes $\frac{7^0}{7}$ on the board]	SCQ	
Teacher: Any number with a zero exponent is always ..?	SCQ	
Learners: One		c

School P2 Lesson 3		
Teacher: ... written in power notation and then written using the same base. <u>Uyabona?</u> {You see?} <u>So xa uyiyenza wena uzoyiyenza ibe ngutwo to the power of 3 divided by two niyabona?</u> {They have given you the long method and they say that you should make it a short method then show it in an equation with the same base. So when you do the sum you will make it two to the power 3 divided by two, you see?} [Teacher writes $\frac{2 \cdot 2 \cdot 2}{2}$ on the board.]	PQ, PQ, PQ,	

Learner: Yes miss.		y
Teacher: <u>Because kwenzeka lanto to the power of 3 divided by two and then yidivision lena, niyayazi idivision?</u> {Because this happens to the power of 3 divided by two and this is division, you do know division?} <u>kuthi</u> {that} when the base are the same you cancel the exponent <u>nhe?</u> {right?} and then <u>yangu two</u> {it became two}, two is the common base and then <u>yangu 3</u> {it became 3} <u>ipower apa ngubani?</u> {what is the power here?}	SCQ, PQ, SCQ	
Learners: <u>Ngu one</u> {It is one}		c
Teacher: <u>Akabhalwa ke but kuthiwa minus one ukuthiwa ifumana ngutwo to the power of two ke, niyabona?</u> {You do not write it but they say minus one. they say the answer is two to the power of two, you see?}	PQ	
Learners: Yes madam		y
Teacher: <u>Lamzekelo?</u> {That example?} <u>and then ke the rest izokwenziwa nini.</u> {and then the rest will be done by you.} and the B, number B <u>ebhodini.</u> {on the board}, number B, two two two two <u>bangaphi na o two ?</u> {how many twos are there?}	PQ, SCQ	
Learner: <u>Bayi 3</u>	SCQ	c
Teacher: Divide by two two <u>Izobangubani?</u> {What is it going to be?}		
Teacher: What is the next step?	IQ	
Learners: [Mumbled, inaudible speech]		c
Teacher: <u>Hayi wonke umntu uyathethe ngoku apha eklasini akukho mntu ungathethiyo. Ithini I next step?</u> {Oh so now every one in class has something to say, what is the next step?} <u>wonke umntu makathethe, uyawubona umzekelo wenziwe njani pha?</u> so ke <u>yonke lanto yenzeka ngolahlobo ndiyiyenze ngalo.</u> {Everyone must talk, you see how I did that example? So then everything happens the way I did it.}	IQ, PQ	
Learners: two to the power of 3 divided by two to the power of two.		c
Teacher: <u>Nithe ngubani?</u> {What did you say is the answer?}	SCQ	
Learners: two to the power of 3 divided by two to the power of two.		c
Teacher: <u>Njani?</u> {How so?}	IQ	
Learners: two to the power of one		e
Teacher: Hmmm?	SCQ	
Learners: two to the power of one divided by two		e
Teacher: two to the ...?	SCQ	
Learners: Power one		c
Teacher: Two into four. Okay, then?	SCQ	
Learners: Two to the power of negative one .. two to the power one		c
Teacher: This is the last activity <u>ke bethuna</u> {people} from combination of multiplication and division <u>niyayibona lonto?</u> {do you see that?}	PQ	
Learners: Yes		y
Teacher: <u>Mayibonakale into oyibhala ebhodini</u> {We must be able to see what you are writing on the board}, <u>yintoni le uyibhalayo?</u> {what are you writing?}. [Learner writes $\frac{33333}{3.3}$ on the chalkboard.]	PQ	

Teacher: <u>Ithini le.</u> {Explain this one.}	IQ	
Learners: Three to the power of five divided by three to the power of two Three to the power of three .. Three to the power of three [Learners applaud the correct answer.]		e
Teacher: <u>Ngubani lo umenzayo wena?</u> {Which number are you doing?}	PQ	
Learners: <u>Ngu F</u> {translation needed}. [Learner writes $\frac{5 \cdot 5 \cdot 5}{5}$ on the chalkboard.] Five to the power of three.		e
Teacher: <u>Akasoze aphinde avume</u> {He will never agree again}, <u>umntu osebhodini</u> {the person on the board} don't talk. <u>Iright?</u> {Is this right?}	PQ	
Learner: Ha-ah ... <u>Khupha unegative.</u> {Take out the negative sign}		e
Teacher: <u>Why eright u-negative two?</u> {Why is negative two right?}	IQ	
Learner: <u>Andiva miss</u> {Can't hear you miss}		n
Teacher: <u>Why eright u-negative two?</u> {Why is negative two right?}	IQ	
Learner: <u>Kaloku bendi-subtracte u one</u> {Thing is I subtracted one}		e
Teacher: This is the last one, <u>ngunumber bani eyokugqhibela?</u> {what number is the last one?}	PQ	
Learners: H, H		n
Teacher: The next one must do number I and M, the next two we will do I and M. Nê? {Right?}	PQ	
Teacher: <u>Uneproblem?</u> {Do you have a problem?} <u>How many 4's ezilapho eleft?</u> {How many 4's are there on the left?} <u>Cancelisha ke ngoku.</u> {Cancel the others now} How many 4's left? <u>Kushiyeke abangahi kengoku?</u> {How many are left now?}	PQ, SCQ, SCQ, SCQ	
Learners: <u>Bayi 4</u> {There's 4}		c
Teacher: <u>That is because ubhale u4 apha and bangaphi aba 4 balapha?</u>	SCQ	
Learners: <u>Bayi two</u> {There's 2}		c
Teacher: <u>Hayibo!</u> {No ways!} How many tens, <u>nah?</u> {translation needed} Number M, Number M.	SCQ	
Learner: I, I, I		s
Teacher: <u>Kanti nikunumber bani na nina? Ngu L?</u>	PQ, PQ	
Learner: <u>Ku I</u>		s
Teacher: <u>Ngubani emva ko K?</u> {What's after K?} <u>Ngu L?</u> {It's L} <u>Ngu L and M</u> {It's L and M}. <u>Uzokwenza eyiphi nkwenkwe?</u> {Which one are you in to do, boy?}	PQ, PQ, PQ	
Learner: <u>L no M</u> {L and M}		c
Teacher: <u>Yes, nokuba wenza u L nokuba u M, ndifuna ibenye.</u> {Yes, you can either do L or M, I just want one.} <u>Bona ukuba uzokwenza eyiphi?</u> {See which one you can do?}	PQ	
Teacher: <u>Uright?</u> {Is he right?}	PQ	
Learners: No miss!!		n
Teacher: <u>Uwrongo phi?</u> {Where is he wrong?}	IQ	
Learner: <u>Iright but miss apha ekugqhibeleni funeka amelanga uyifake ...</u> {It is right but at the end he was not suppose to put ...}		c

Teacher: <u>Ungayi simplifier ke but still nokuba uyishiyile injeyana iright because kuthiwa apha encwadini niyevani?</u> {You can still simplify it, even if you leave it like that it is still correct, that is what the textbook says. Do you hear?}	PQ	
Learners: Yes.		y
Teacher: Right, <u>u4 basically is the same so it's 3 into 4 minus 4 that is why eno 3 into 0 niyabona?</u> {4 basically is the same, so three to four minus four is why he has three into zero, you see?}	PQ	
Learner: Yes.		y
Teacher: <u>Ngeviphi ibase?</u> {Which one is the base?} <u>Nokuba ubunokumbuza akayazi ibase.</u> {Even if you would ask him he does not know what the base is.}	SCQ	
Learner: <u>Ibase miss, ngu 10</u> {The base miss is ten}		c
Teacher: <u>Ibase ngu 10</u> {The base is ten}, then?	SCQ	
Learner: <u>I-exponent ibe ngu4 ... ngu 0.</u> {The exponent is four ... zero} [Learner at the board changes his answer to 10^0 .]		c
Teacher: <u>Uyabuza lona njani?</u>	SCQ	
Learner: <u>Xolo miss akushiyeki nto xa ulantuka?</u> {Excuse me miss, there is nothing left when you} ... <u>xa ukhanselisha.</u> {when you cancel.}		c
Teacher: Multiplication, if you are multiplying you know the rule when the base are the same. What is the rule of multiplication with exponent? ... [The learner at the board still struggling to write down the next problem - he writes $3^4 \times 3 - 2 \times 3$. This takes about one and a half minutes. The teacher eventually corrects this to $3^4 \times 3^2 \times 3$.]	IQ	
Teacher: Multiplication, what is the rule for multiplication when you are multiplying exponent? .. Hmmm?	SCQ, SCQ	
Learners: [Mumbled speech]		e
Teacher: And then 3 and then 4 minus two and here? .. Hmmm?	SCQ, SCQ	
Learners: Plus one		c
Teacher: <u>He bethuna! then ngubani i-answer? Abantu ngoku abayazi kodwa siqale ngayo imultiplication.</u> {People now do not know but we started with multiplication}	SCQ	
Learner: Three to one		c
Teacher: <u>Nenze njani?</u> {How did you do it?} 4 minus two?	IQ, SCQ	
Learners: Two		
Teacher: Then it's three nê? {right?} into three. Then what is three into three? What is three into three? If you are changing this into a number...if you are changing it into a number ngubani?	PQ, SCQ, SCQ	
Learners: <u>Ngu one</u>		c
Teacher: <u>Bangaphi aba 3?</u> {How many three's are here?}	SCQ,	
Learner: <u>Ngu twenty seven miss.</u> {It's twenty seven miss.}		c
Teacher: <u>Yho!</u> {Pheew!} number? <u>Bendithe ngu number bani lento?</u> {What number did I say this is?}	SCQ, SCQ	
Learners: E		n

Teacher: <u>So izakuba ngubani i-answer pha?</u> {So what is the answer there?}	SCQ	
Learners: Five		c
Teacher: Hmmm?	SCQ	
Learners: Three to the power of five.		c
Teachers: <u>Uyekwelandelayo ngaphayana.</u> {Go to the next one on that side} and then <u>kuleyana ngubani?</u> {what is that one?}	SCQ	
[Learner continues to write on the board with the help of other students.]		e
Teacher: <u>Umfumene njani uPlus five?</u> {how did you get plus five?} <u>lo plus five umfumene njani?</u> {how did you get this plus five} This one is division and this one is ..?	IQ, IQ, SCQ	
Learners: Multiplication		c
Teacher: So where do you get the positive five? Because it say it's positive. Five is having negative. Nê. {Right?} Hmmm? This is multiplication, this side is multiply, this one is division so the rules are not the same. You know the rule of multiplication and you know the rule of <u>intoni?</u> {what?}	IQ, PQ, SCQ, SCQ	
Learners: Division		c
Teacher: So where do you get to this part? <u>Nonke nithe ngu five nimyekile njena.</u> {You all said five and let him write five}	IQ	

School P3 Lesson 1		
Teacher	Ibenento iphinde ibenzentoni enye into [What other things do they do?] <u>except utshintsha ibe yi fraction kusabezethini?</u> [We can expect them to change to fractions] <u>Yeyiphi enye into eziyenzayo irrational number ngaphandle kwalanto?</u> {What other thing do rational numbers do except for that} <u>Khandinike isymbol ye rational number.</u> {Give me a symbol for rational numbers.} <u>Besithe xa sifuna siyipresenter kanjani kanene?</u> {We said if we want to represent it, how do we represent it again?}	SCQ, SCQ, IQ, SCQ, SCQ
Learner	Ngo Q [with Q].	c
Teacher	<u>Ngo Q , nê?</u> {With Q , right?}	PQ
Learners	Yes, miss.	y
Teacher	that is a over b <u>njalo, njalo</u> {a/b, etc} or eks over one <u>njalo, njalo</u> {x/1, etc} and also <u>ngeziphi ezinye inumbers?</u> {which other numbers?}	SCQ
Learner	<u>Ziintegers.</u> {It's integers}	c
Teacher	<u>Iintegers zinumbers ezitheni kanene?</u> {What are integers again?} Positive and Negative.	SCQ,
Learners	Negative.	c
Teacher	Then <u>ke ngoku phayana</u> {then what about there?} we are going to see i-difference between <u>i-rational</u> {rational} and irrational numbers. <u>Niyeva?</u> {Do you hear?} <u>Siyeva hayana ukuba irrational numbers zona zibhalwa ngokwahlukileyo phaya kwi rational numbers siyevana?</u> {Do we agree that irrational numbers are written differently to rational numbers?} <u>Lanto efakelwa phayana ilichaphaza uzobona umehluko ngaphakathi kwazo, xa irepresentwa pha ubona la symbolism injena ithethe ntoni?</u> {the dot we put over Q shows irrational numbers., what does that symbol mean to you?}	SCQ, PQ, PQ, PQ, SCQ
Learners	No it carries on.	n
Teacher	What is the value of $\sqrt{2}$, class?	SCQ
Learners	1 comma 4	

Teacher	Right - Look to examples: Irrational number gives an answer that is infinite. siyevana? {Do you understand?} square root, isquare root of 3 undinike ianswer epheleleyo siyevana? {and give me the full answer do you understand?}	PQ, PQ
Learners	Yes Miss. 1 comma 7 3 2 0 5 0 8 0 8	y, e
Teacher	- What is $-\sqrt{12}$?	SCQ
Learners	→ 3,4610.....	c
Teacher	-You cannot speak as a mass choir. Iphelele phayana? {Does it end there?}	PQ
Learner	No it continues.	n
Teacher	Yes it continues. right? {so let us check those examples that are there at the bottom, do you understand?}	PQ, PQ
Learners	Yes	y
Teacher	The number on the right hand side goes on and on, have you noticed?	PQ
Learners	Yes	y
Teacher	i-answer zakhona azirikheri and azifomishi pattern siyevana? {The answers do not form any pattern, do you understand?}	PQ
Learners	Yes	y
Teacher	Number 3, $\sqrt[3]{28}$ siyevana? {do you understand?} square root, isq of undinike ianswer epheleleyo siyevana? {and give me the full answer do you understand?}	PQ, PQ
Learners	Yes Miss	y
Teacher	Yimani kuqala ndiyibhale pha ebhodini nê? {Wait let me first write it on the board.}	PQ
Learners	Yes Miss	y
Teacher	Khandinike isquare root of 3 nê? {give me the square root of 3}	PQ
Learners	1 comma 7 3 2 0 5 0 8 0 8	e
Teacher	Okay, Okay niyabona ukuba la answer ninayo pha ayi termineti? {Do we see that the answer does not terminate?} Siyevana? {do you understand?} Awunokwazi ukuyiqikelela ayifani napha kwi rational numbers apho ubone ukuba there is a pattern nokuba inumber yakho ayithini??? {You cannot guess it, unlike rational numbers where you sometimes spot a pattern even if the number does not? } Mhlawumbi kukhona inumber ezirikherishayo. {maybe there is a number that recurred} Yona ayi rikherishi ikunika nje ianswer ezininzi siyevana? {it does not recur but just gives a lot of numbers} Do you understand?	SCQ, PQ, SCQ, PQ
Learners	Yes Miss	y
Teacher	Masikhe sijongeni pha la {let's look there} negative square root ka 12 ianswer yakho pha oyifumeneyo... {the answer that you got here}	SCQ
Learners	3 comma 4 6 1 0 ...	e
Teacher	Anina kuthetha nonke nje, nindinika njalo. {you cannot all speak at once, don't give it like that} It's negative 3 4 6 1 0	SCQ
Learners	1 6	
Teacher	Isquare root, icube root, yintoni la number? {what is that number} Z Ibizwa ukuba yintoni	SCQ,

	kanene eno 28? {What do they call that with 28?}	SCQ
Learners	Cube root	
Teacher	It's a cube root, cube root of 28. Who can find ianswer ka tube root of 28? yimake khawume ndiqale ndizibhale ezinto, {wait let me first write this} tube root of 28 ilingana nabani {what is the equivalent of} icube root of 28?	SCQ, SCQ
	Learners: {Mumble}	
Teacher	Number 3, $\sqrt[3]{28}$ siyevana? {Do you understand?} Undinike ianswer epheleleyo siyevana? {And give me the full answer do you understand? 3 comma?}	PQ, SCQ
Learners	Zero comma????	
Teacher	3 comma 06?	SCQ
Learners	- 65899	
Teacher	So uyabona ukuba{so you see that} it is wise into yokuba wonke umntu makabenayo icalculator? {for everyone to have a calculator}	SCQ
Learners	Yes Miss	y
Teacher	you won't know ianswer without using icalculator nê am I right?	PQ
Learners	Yes	y
Teacher	Yintoni kanene unumber 4? {What is number 4 again?} Who can tell me? What does that symbol represents in number 4?	SCQ, SCQ, SCQ
Learners	π	
Teacher	π nê?	PQ
Learners	Yes	y
Teacher	π , Khawube undilantukela..... pha kwi scientific calculator if uyayi yenza pha izakunika ianswer nê? {please do that on the scientific calculator if you can and give me the answer}	PQ
Learners	Yes	y
Teacher	Sidla ngoku yisebenzisa for ukwenza ntoni kanene $i\pi$? {What do we use π for?} Where do we normally use that symbol π , when we calculate?	SCQ, SCQ
Learner	In circle	c
Teacher	We use it to calculate icircle?	SCQ
Learners	Circle	c
Teacher	So ithini pha ianswer oyifumanayo xa usenza I pi? {what answer do you get when you calculate π ?} 3 comma ?	SCQ, SCQ
Learners	1 4	c
Teacher	Aniyifumenanga? {Have you found it?} Abo bane {who are those?}	PQ, PQ
Learners	{Mumbled again}	e
Teacher	khawubachazele {tell them} how did you get the value of π ? they cannot give you ilantuka baxelele kaloku wenze njani? {Please tell them how you did it} How did you get your answer kwi π ? Nge {with} second function Bethunana siyevana? {People do you understand?}	IQ, IQ, IQ, PQ

Learners	Yes	y
Teacher	So kwaba bangenazo icalculator {to those who do not have calculators, it will be difficult to know how to find the value of π . ukuba yenziwa kanjani? {how you do this?}	PQ
	Learners started making a noise.	
Teacher	‘Shuuuuu’ she exclaimed, Mamela ke nê? {listen} okay masipheze kengoku nê? {Can we stop now the noise please?} Can we listen now? that is why those numbers sithi kuzo {We name them as irrational..... Ntoni? What? }	PQ, PQ, PQ, SCQ
Learners	Numbers	c
Teacher	write to the nearest or two decimal places. Do you understand?	PQ
Learners	Yes	y
Teacher	They say correct number to 2 decimal places Siyevana? {Do you understand?} Because ku avoidwa into yokuba ubhale into ende phayana engapheliyo nê? {They are trying to avoid writing long numbers} enga terminatiyo siyavana? {That does not terminate, do you understand?}	PQ
Learners	Yes miss	y
Teacher	when we write it into 3 decimal places, we must have 3 numbers after the comma	SCQ
Learners	I comma	c
Teacher	Ehmm, If ela nani lethu phayana lingu 5 { If our number is 5 or more} Which is ke ngoku la 2 wethu {which is 2 in our case} izakuba ngubani? {What will that be?} Izakuba ngu 3, {it is going to be 3} but into eyenzekayo ke ngoku inani lethu lenza ntoni? {What happens to our number?}, So xa li less than phaya ku 5? {So if it smaller than 5?}. Uzobhala ke ngoku 1 comma 7 3 2 {it does not change, you will write as 1, 732} siyevana? {Do you understand?}	SCQ, SCQ, SCQ, SCQ, PQ
Learners	Yes	y
Teacher	Masijonge naleyana siyise kwi 2 decimal or ku 3. uright u3 nê? {Let us look up there and try to change it to 2 decimal or 3 decimal numbers. 3 decimal is right, is it so? }	PQ,
Learners	2	c
Teacher	Niyifuna ku 2? {Do you want 2?} Okay fine, le sizakuyitshintsha {change to 2 decimal places} Which is sizojonga amanani amangaphi {how many numbers do we need after the decimal comma?}	SCQ, SCQ,
Learners	{Mumble} and others say 2	c
Teacher	but before sibhale ke ngoku ela xa siyenza to 2 decimal places sizojonga eliphi? {but before we write this number to 2 decimal places, in which number are we going to look at?}	SCQ
Learner	1	c
Teacher	Sizojonga u 1 nê? {We are going to look at 1} understood? So kwenzeka ntoni phayana? {What happens there?} Xa li less than 5? {if the number is less than 5?}Because la 1 utheni? {What happens to that 1?}	PQ, SCQ, SCQ, SCQ
Learners	uLess than 5	e
Teacher	uLess than 5 kuza kwenzeka ntoni ke ngoku pha ku 6? [It's less than 5, then what is going to happen to 6?}	SCQ
Learners	Siza kumbhala enjeyana. { we will write as it is}	e

Teacher	Siza kumbhala enjeyana asizomtshintsha u 6, {We are going to write it as is because the number is less than 6} enjeyana is less than? 5	SCQ
Learners	5	c
Teacher	3 comma 0 3 sizakuyenza to 2 decimal or 3? Siyenze kwintoni? {We will change it to 2 or 3 decimal places, which one do you prefer?}	SCQ, PQ
Learners	3	c
Teacher	Siyenze kwi 3 decimal places so which means sizojonga how many numbers after idecimal place? {Let's write it to 3 decimal places and try to notice how many numbers after the comma}.	SCQ
Learners	3 numbers	c
Teacher	Sojonga 3 so ibeyintoni? { we will look to 3 then what?} 3 comma 0 3 but before umbhale ke ngoku la 6 kuzofuneka sijonge bani phayana? {Before we write 3, 03 - what should we look at first?}	SCQ, SCQ
Learners	5	c
Teacher	-Sijonge lo 5 nê? {Let's look at 5, okay} so ke ngoku ela nani ngu 5 kuzo funeka kwenzeka ntoni ke ngoku pha? {From that number 5, what is going to happen there?}	PQ, SCQ
Learner	Faka u 1 linyuke {add 1 to make it bigger}	e
Teacher	Lizo increaser and then we add u1 ngaphayana nê? {add 1}	PQ
Learners	Yes	y
Teacher	3 comma 0 3 7. lena siyiyenza 2 decimal? {Is this 2 decimal?}	SCQ
Learners	3 decimal nokwayo [this is 3 decimal]	e
Teacher	Nifuna ukuthi 3? {You want to say 3?}	SCQ
Learner	Ewe {yes}	y
Teacher	masiyitshintshe into 2 nê? {let's change it to 2 decimal places} izakuba ngubani kengoku phayana? {What will be the answer now?}	PQ
Learner	3 comma 1 4 { 3,14}	c
Teacher	Then uyajonga kweliyana lesithathu into yokuba li less than or more than 5 na, {look at the number whether its less than 5 or not} i less than 5 uzothini phayana? Then {if it is less what are you going to do?}	SCQ,
Teacher	Bakhona aba bangayenzanga neh? {There are those who did not do it, neh?}	PQ
Learners	Yes	y
Teacher	Masisebenzise I {Lets use our } calculator zethu because its easy icalculator yakho does the work for you neh?	PQ
Teacher	Masijonge kwi ratio ukuba what is a ratio? {Idefinition of a Ratio} pha, ngubani ozakusifundela ye ratio? {Who is going to read from the definition of the ratio from the book?}	SCQ, SCQ

School P6 Lesson 1

Teacher:	Okokuqala phaya {firstly there} we've got a to the power zero, we want to see ukubana {that} a to the power zero uzakuphela esinika ntoni na {what will the answer be?} right?!	PQ	
Learners:	Yes		y
Teacher:	As we are dealing with exponents we did law one of the exponents, apho besisithi {whereby we said} if you multiply power of the same base, what do we do kanene? {again?}	SCQ	
Learners:	You leave the base as it is		c
Teacher:	For instance lets say we a to the power two times a to the power three $\{a^2 \cdot a^3\}$ what do you say we going to do?	SCQ	
Learners:	Responding but cannot make sense.		e
Teacher:	Ok! We put the exponents...the base as it is nhe? {right?}	PQ	
Learners:	Yes		y
Teacher:	Then? You add two plus three andithi? {is it not?}	SCQ, PQ	
Learners:	Yes		y
Teacher:	Equals to?	SCQ	
Learners:	a to the power of five.		c
Teacher:	Here we still multiplying powers of the same base nhe? {right?}	PQ	
Learners:	Yes		y
Teacher:	Ok! What are we going to do?	IQ	
Learners:	a to the power three plus open brackets negative three. $a^{3+(-3)}$		e
Teacher:	Ok! We write that number in brackets because its number is negative, and then?	SCQ	
Learners:	Equals a to the power three		e
Teacher:	And then we will work out this, plus times a negative?	SCQ	
Learners:	Negative three		c
Teacher:	So it means this a to the power zero siye sibe naye xa besi-multipliyisha ii-powers {we had it when we multiplied the powers} whose exponents are equal but with different signs andithi? {right?}	PQ	
Learners:	Yes		y
Teacher:	this is from law one that is multiplication of powers within the same bases andithi? {right?}	PQ	
Learners:	Yes		y
Teacher:	Lets say we have this, a to the power four divide by a to the power four, this time we are dividing than what do we do?	SCQ	
Learners:	Learners: a to the power four		c
Teacher:	a to the power four times?	SCQ	
Learners:	minus		c
Teacher:	This boy is telling us if we are dividing we have to subtract, ok! unyanisile? {is he correct?} We are not going to multiply we are going to subtract, so what are you going to subtract?	IQ, SCQ	
Learners:	Learners: four minus four		c
Teacher:	Teacher: Is equal to?	SCQ	
Learners:	Learners: a to the power zero		c
Teacher:	but asikamboni ukuba this a to the power of zero ulingana nabani na andithi? { but we have not seen that this a to the power of zero is equal to what?	PQ	
Learners:	Yes		y
Teacher:	Ok lets do it in another way, a to the power four, if we are expanding iba ngubani? {what will the answer be?}	SCQ	
Learners:	axaxaxa divide by axaxaxa		c

Teacher:	Ok! What do we see in our numerator and denominator? So a uyakangaphi apha? {a goes into here how many times?}	SCQ, SCQ	
Learners:	one, one, one...		c
Teacher:	So what are we left with?	SCQ	
Learners:	One		
Teacher:	Kwi-numerator { at our numerator} we are left with?	SCQ	
Learners:	T&L: one times one times one times one		c
Teacher:	Equals to?	SCQ	
Learners:	one		c
Teacher:	and then at the denominator we are left with?	SCQ	
Learners:	one times one times one times one times one		c
Teacher:	Is equal to?	SCQ	
Learners:	one		c
Teacher:	So one over one is equal to?	SCQ	
Learners:	One		c
Teacher:	what do you notice here? We have a divided by four equal to?	IQ, SCQ	
Learners:	one		c
Teacher:	Xa sisebenzisa { when we are using} this method of expanding our powers andithi? {right?}	PQ	
Learners:	Yes		y
Teacher:	Yes but if sisebenzisa {we use} that law, the second law ze-exponents zethu {of our exponents} sifumana {we get} a divided by a is equal to a to the power zero than what can you say?	SCQ	
Learners:	Saying something but cannot make sense.		e
Teacher:	Ok! a to the power zero is equal to?	SCQ	
Learners:	One		c
Teacher:	I think we all know that when we are dividing any number by itself, we get?	SCQ	
Learners:	one		c
Teacher:	Andithi? {is it not?}	PQ	
Learners:	Yes		y
Teacher:	It means lo nto { that} two divide by two equals to two to the power zero. So this two to the power zero is the same as?	SCQ	
Learners:	one		c
Teacher:	and we know that if there is no exponents we know that it is one, so we apply the second law of the exponents that when we are dividing the powers of the same base we subtract the exponents, one minus one is equal to?	SCQ	
Learners:	two to the power zero		c
Teacher:	is equal to?	SCQ	
Learners:	one		c
Teacher:	So any power with the exponent zero is equal to?	SCQ	
Learners:	one		c
Teacher:	What is the answer to this one, ten to the power zero? Ten to the power zero?	SCQ, SCQ	
Learners:	one		c
Teacher:	Ten to the power zero is one, and what about (2x) to the power zero?	SCQ	
Learners:	one x		c
Teacher:	Is equal to one. (abc) to the power zero?	SCQ	
Learners:	One		c
Teacher:	Is equal to?	SCQ	
Learners:	one		c

Teacher:	If you say two-hundred to the power zero, the answer is going to be?	SCQ	
Learners:	one		c
Teacher:	Sijonge kengoku xa sine-negative exponent { lets look at when we have a negative exponent} most of the time we do not like to give our answers with negative exponents nhe? {right?} For instance maybe we have two to the power minus one, and the question says write the power without a negative exponents, how are we going to write it?	PQ, PQ	
Learners:	Saying something but cannot make sense of it.		e
Teacher:	Ok! we change that power and write it as a fraction, but i-fraction ke ayizusuka kude, asizuthatha { the fraction wont be taken afar and we wont take it} from other numbers from outside, amanani siwasebenzisa { we use the numbers} from here, siyavana? {do we understand each other?}	PQ	
Learners:	Yes Miss {teacher}		y
Teacher:	We got only one power apha {here} andithi? { is it not?}	PQ	
Learners:	Yes		y
Teacher:	Singaphi ii-powers apha? { how many powers that are here?}	SCQ	
Learners:	one		c
Teacher:	Do we have any number that is written in front of this number?	SCQ	
Learners:	No		n
Teacher:	And if we don't have a number we take that the number that is there is equal to?	SCQ	
Learners:	one		c
Teacher:	The number that is here is equal to one, so we've got one of this power, so if its one of.... Its like one times its power andithi? { is it not?}	PQ	
Learners:	Yes		y
Teacher:	So we are going to change its power to a fraction, sizakuyitshintsha kanjani? { how are we going to change it?} Sonke mos siyayazi ukuba i-fraction { we all know that a fraction has got a numerator and a denominator but now how are we going to write that fraction?	IQ, IQ	
Learners:	Saying something but cannot make sense of it		e
Teacher:	Ok! the answer is going to be one over two to the power one, do we all Agree?	PQ	
Learners:	Yes		y
Teacher:	Others say yes, others say no. Ok! I agree that the answer is one over two, but izakanjani lo nto? { how does that come about?}		
Learners:	Saying something but cannot make sense of it.		e
Teacher:	How many powers are here?	SCQ	
T&L:	Its one		c
Teacher:	So this one will be? The numerator andithi? { is it not?}... change this negative to the exponent, and again she's telling us an exponent that is equal to one asizokuyi bhala { we don't usually write it} so the answer to this is equal to one over two siyavana? {do we understand each other?} Ok! who can tell me an answer to this one four to the power negative one?	SCQ, PQ	
Learners:	one over four		c
Teacher:	would be?	SCQ	
Learners:	one over four		c
Teacher:	I want that without a negative exponent, how are we going to write the without a negative exponent? Hands up?	IQ, PQ	
Learners:	two over two x to the power three.		c
Teacher:	Do we all agree?	PQ	
Learners:	No....yes { not sure}		vr
Teacher:	Than what about this one. a to the power negative one b to the power two c to the power negative three { $a^{-1} b^2 c^{-3}$ } what is it going to be without a negative exponent? Hands up?	IQ, PQ	

Learners:	b to the power two over ac to the power three		e
Teacher:	Before sisebenze ukhona umntu onombuzo? {Before we start working, anyone with a question?} Ukhona osele egqibile ayokusibonisa ebhodini? { is there anyone who has finished and go show us on the board?}	PQ, PQ	
Learners:	/Learner going to the board to do number thirteen/		
Teacher:	Do we all agree?	PQ	
Learners:	Yes		y
Teacher:	Can you tell us how you got this one as an answer?	IQ	
Learners:	Saying something but cannot make sense.		e
Teacher:	So any number with exponent zero is equal to one so which of the two numbers has got an exponent zero?	SCQ	
Learners:	it's a...		vr
Teacher:	We've got five times a to the power zero or five a to the power zero?	SCQ	
Learners:	Saying something but cannot make sense of it.		e
Teacher:	Okokuqala {firstly} what are these two things, are they multiplying or are they dividing or are we adding or subtracting? What is happening here? When there is no sign in between, what is happening? We are?	SCQ, SCQ, SCQ, SCQ	
Learners:	Multiplying		c
Teacher:	Ok! its only that one that gives us one andithi? {is it not?}	PQ	
Learners:	Yes		y
Teacher:	this is what she has written two to the power negative three which equals to one over two to the power three. Is she right or wrong?	PQ	
Learners:	right...wrong		vr
Teacher:	Ok! the last one before sizenzele { we do it individually} Lets do number nine, who is going to do number nine for us?	PQ	
	/Learner going to the board to do number nine/		
Teacher:	Teacher: Is this one correct?	PQ	
Learners:	Yes I-wrongo { it is wrong}		vr
Teacher:	Teacher: Ok! wonke umntu othi i-right makaphakamise isandla? {Everyone who agrees with the answer raise your hands up} the whole class, Ok!	PQ	

School P7 Lesson 1			
Teacher	8times 8 is 64, right, what is the square root or 64?	SCQ	
Learners	8		c
Teacher	Yes O.K I'm not telling you because you asking questions... um asking the others um if 8 times 8 is 64 right then what is 6 times 6?	SCQ	
Learners	36		c
Teacher	O.K. and what is 6 squared	SCQ	
Learners	6 squared?		c
Teacher	6 squared?	SCQ	
Learners	I don't know Miss		n
Teacher	what is 2 cubed? Remember cubed is to the power of 3 nuh? Right? So what is 2 cubed?	SCQ, PQ, PQ, SCQ	
Learners	4		c
Teacher	2 times 2 times 2. so if 2 what is 2 times 2?	SCQ	
Learners	4		c
Teacher	4 times 2?	SCQ	
Learners	8		c
Teacher	So, 2 cubed is?	SCQ	
Learners	8		c
Teacher	That's 2 squared ... so ..O.K. so if 2 cubed is 8, then the cube root of 8 is what?	SCQ	

Learners	Of 8? Um 2		c
Teacher	Right, so what do we see? That is um that square root and squares ... or squares er numbers they work hand in hand isn't it? Farzaan? Isn't it Farzaan	PQ, PQ, PQ, PQ	
Learners	yes Miss		y
Teacher	Frazaan, or Farzana – right, so Farzana uh what is 3 squared?	SCQ	
Learners	[Gesticulates and answers inaudibly]		c
Teacher	So, the square root of 9 is 3	SCQ	
Learners	3		c
Teacher	3. so what do we see? That they work?...	PQ, PQ	
Learners	Together		c
Teacher	O.K. as this page is .. are there any folds on this page?	PQ	
Learners	No		n
Teacher	So.. if there's no fold, right, we have 1 page, isn't it?	PQ	
Learners	Yes		c
Teacher	1 half forming 2 parts, right? So, now with 1 fold right, remember, no fold, you have 1 page right, 1 fold you have? [asks the class]	PQ, PQ	
Learners	Two		c
Teacher	And how many parts?	PQ	
Learners	4 parts.		c
Teacher	4 parts right ... like so..[inaudible word] parts right, now fold that oh! You did fold it.. how many parts do you have?	PQ	
Learners	4		c
Teacher	you have 8, alright ..[Turns to write in board] so your third fold is equivalent to 8 parts, isn't it?	PQ	
Learners	Yes		
Teacher	How many parts do you get?	SCQ	
Learners	16		c
Teacher	You can .. just press it down hard with a ruler - [class follows] so you can see your folds[looks at class while folding hers] how many folds do you have now?	SCQ	
Learners	Class [shouts out answer] 20 [– some inaudible]		c
Teacher	[Turns to write on board] Who of you got 32	PQ	
Learners	No one		n
Teacher	How many?	PQ	
Teacher	32 [turns to write on board – turns to class] Can you fold another time?	SCQ	
Learners	Ja, Miss		y
Teacher	Right 64 it is [Turns to write on board] 6folds 64 O.K. , now given the amount of parts to the amount of folds what do you notice? [Waves in front of board] .. Farwaaz?	PQ	
Learner	[Answers inaudibly]		vr
Teacher	Is what?	SCQ	
Learners	[using calculators] 2		c
Teacher	1 Try 2 to the power of 2	SCQ	
Learners	4		c
Teacher	2 to the power of 3	SCQ	
Learners	8		c
Teacher	Are you getting those answers?	SCQ	
Learners	Yes Miss		y
Teacher	so.. in other words your er ..um the more parts you have sorry, sorry the more folds er every time you fold, the more parts you produce? Isn't it?	SCQ, PQ	
Learners	[inaudible – agrees with Ed]		y
Teacher	like you um, you people know that 2 squared um you people are familiar with square numbers and cubed numbers you did that right? So for example 2 squared where 2 is your what?	PQ, SCQ	
Learners	Your base		c

Teacher	Your base and the 2 on top is?	SCQ	
Learners	exponent!		c
Teacher	your exponent, right. O.K. er O.K. we also know that 2 squared is equal to to what? If you write it out.	SCQ	
Learners	2 times 2		c
Teacher	2 times 2 you multiply it by itself only once and if : 2 times 2 .. to the power of 2 is : 2 times 2 .. then what is 2 to the power of 3?	SCQ	
Learners	2 times 2 times 2 times 2		c
Teacher	times 2 . right 3 times isn't it?	PQ	
Learners	Yes		y
Teacher	O.K. so if 2 to the power of 2 is : 2 times 2 and 2 to the power of 3 is : 2 times 2 : times 2 times 2. then what do think is 2 to the power 1?	SCQ	
Learners	is 2 , 2 times		c
Teacher	However, if I put, if I put 2 on top [shows on the board]or as an exponent or a 3 on top as an exponent then it becomes 2 to the power of 2 and 3 to the power of 3 or 3 to the power of a hundred and so on do ..do you get me?	PQ	
Learners	Yes		y
Teacher	right, so now like I said 2 to the power of 1 is mos 2, so anything to the power of 1 is that number Are you clear on that?	PQ	
Learners	Yes Miss		y
Teacher	Right so now is it safe to write our powers on our our free standing numbers here [points to board]	PQ	
Learners	yes		y
Teacher	right so we can write our powers, so, what do you notice .. what do you notice concerning er multiplying exponents, or exponent numbers	IQ	
Learners	Plus!		c
Teacher	Plus! What do you plus	IQ	
Learners	Plus the one ..the one [another L. interjects] The exponents		vr
Teacher	You add the exponents, isn't it? So .. there you have it.. you have a rule	PQ	
Learners	[interjects inaudibly]		c
Teacher	In a er when er in in multi multiplications of er exponents, you add the? [waits for reply .. inaudible] Sorry in the base, oh, and you notice that the bases are also all the same. Can ad d your exponents and keep your base. Isn't it?	SCQ, PQ	
Learners	Yes		y
Teacher	Your bases are the same and you added your exponents. Is that, Is that correct?	PQ	
Learners	plus [L. interjects] what .[.inaudible] Miss now it looks Miss?		c
Teacher	If I'm gonna have er .. maybe 2 squared times 3 squared , is that what you asking me? is different.	SCQ	
Teacher	2 to the power of 2. times 2 to the power of 3. what do I do	SCQ	
Learners	Times the base [another L.] Times the base.		c
Teacher	First what do you do with your base?	SCQ	
Learners	[inaudible] [more than one learner speaking]: Keep your base.		e
Learners	yes		y
Teacher	and you get your answer you write it er you can write it out er or you can just um check on your Calculators. 2 times 2 times 2 times 2 times 2 isn't?	PQ	
Learners	Yes Miss		y
Teacher	Right, so 2 times 2 is what?	SCQ	
Learners	4		c
Teacher	2 times 4 is what?	SCQ	
Learners	8		
Teacher	8 times 2 is what?	SCQ	c
Learners	16		c
Teacher	16 times 2 is	SCQ	
Learners	32		c

Teacher	32! Do you understand that now?	PQ	
Learners	Yes Miss		y
Teacher	Right, so our bases are the same, and we add our exponent isn't it?	PQ	
Learners	Yes Miss		y
Teacher	O.K. now er another one 3 to the power of times 3 times 3 to the power of 2. what do we do? er ..er . [looks around Class, calls a name] Nathier?	IQ, SCQ	
Learners	Nathier [Class: murmuring]		ncb
Teacher	Tarryn nuh? Tarryn	SCQ	
Learner	you keep the 3 nuh Miss?		c
Teacher	so this now is the new sum. So how do I express it? Like this {writes on board}	IQ	
Learners	3 times 3 times 3 times 3 times 3		c
Teacher	Now now I want the answer now..now you times 3 times 3 is?	SCQ	
Learners and Teacher	9 .. 9 times 3 is 27		c
Teacher	27 times 3 is?	SCQ	
Learners	50.. 50 54 [laughter] 51!		c
Learners	81 ..81		c
Teacher	times 3 times	SCQ	
Learners	81		c
Learners	243		c
Teacher	2 hundred and?	SCQ	
Learners	43		c
Teacher	right so that first you write an exponent form then you express it, then you give the answer .. right we understand that?	PQ	
Learners	Yes Miss		y
Teacher	Now this here is indeed a rule of multiplication for multiplication of exponents where your base are the same and you add your exponents.e we clear on that?	PQ	
Learners	Yes		y
Teacher	Fawaaz, why are you walking around?	PQ	
Teacher	What do you want? [walking toward L.] Zahier [inaudible – sounds like] Sadien		
Learners	Sadien		ncb
Teacher	Can she sit next to you?	PQ	
Teacher	Wiedaad! Write finish! Where's your content?	PQ	
Learners	[Wiedaad says something inaudible]		ncb
Teacher	When you done I need you to do something else for me quick nuh?	PQ	
Teacher	Firstly, why aren't you writing in here?	PQ	
Learners	In my bag Miss!		ncb
Teacher	No! but you were sitting there also. now how come you not writing ?	PQ	
Teacher	Are we all halfway yet?	PQ	
Learners			si
Teacher	Are we done?	PQ	
Learners	Yes, Another L.: No!		vr
Teacher	75? [to a learner whose work is being checked], 75, the following.	SCQ	
Teacher	Are we done?	PQ	
Teacher	1 to the power of anything is?.. one to the power of anything ..any number 1 to the power of 10 1 to the power of a hundred one to the ..	SCQ, SCQ	
Learners	10		c
Teacher	1 to the power of [indistinct] is equal to 1 times 1 isn't it? And 1 times 1 is ..1 to the power of 3 is is equal to to 1 times 1 times 1 .. 1 times 1 is 1: 1 times 1 is 1 and so on so, its always gonna be 1	PQ	

School P7 Lesson 2

Teacher	Why you stand up? Stay up...stay up..move away from the desk. Thank you.O.K.[one or two learners talking] Hilton..What is a prime number?	PQ, SCQ	
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Learners	[learner says nothing indistinct] Yaw miss!		ncb
Teacher	Why is 5 a prime number	IQ	
Learners	[Talking]		
Learners	L: 5		c
Teacher	That is an example of a prime number. I'm asking what is a prime number?	SCQ	
	[Class continues talking]		
Teacher	If 5 is a prime number, what is a prime number?	SCQ	
Learners	Class [Still talking among themselves]		
Teacher	E: If 5 is a prime number. Why is it a prime number?	IQ	
Learners	L: [Indistinct] Prime number..[Indistinct]		c
Teacher	E: There we go, he said prime numbers only has 2 factors....Who said you can sit? [To another learner] Only has two factors.. itself and 1 isn't it?	PQ, PQ	
Learners	Yes Miss.		y
Teacher	Right – Kevin..No[mumbles something] Uhm..Suleiga what is a composite number?[Class talking]	SCQ	
Teacher	E: If a prime number only has 2 factors right? The composite number is the other one...	PQ	
Learners	L: [Says something indistinct]		c
Teacher	E: Yes ..you. 2, Oh if..square, if uhm, the square root of 4 what is 2 squared ?	SCQ	
Teacher	E: Nobody's reading ... Zakarayah .. What is the square root of 16? the square root of 16 Is not 8 Zakareyah. Which figure holds the square root of 16.. uhm [learner says something indistinct]	SCQ, SCQ	
Teacher	E: The square root of 16 ..square root of 16...guys and girls..[Learners still talking]	SCQ	
Learners	L: 4 Miss		c
Teacher	E: If the square root of 16 is 4 then 4 squared is what? [A few learners] 16	SCQ	
Teacher	E: 16... if 2 to the power of 3.. or 2 cubed is what? Everybody!	SCQ	
Learners	L: 8		c
Teacher	E: 8... Then what is the cube root of 8?	SCQ	
Learners	L'S: 2		c
Teacher	E: 2 – if 3 cubed is 27 what is the cube root of 27?	SCQ	
Learners	L'S: 3		c
Teacher	E: 3... So what do we notice? [Gesticulates to class]	IQ	
Learners	L: [Indistinct][Then says]....Opposites		c
Teacher	E: I notice..I notice can..can you all listen now?	SCQ	
Teacher	E: What that? [Learners still talking.]	SCQ	
Teacher	E: Right! We all know what is natural numbers right? What are natural numbers?	PQ SCQ	
Learners	Class: 1,2,3,4,5.. [Educator interrupts]		c
Teacher	E: And so on right? Etcetera.	PQ	
Learners	L: 7,8.		c
Teacher	E: Runs between negative 5 and 20[writing on board] isn't it? Right so what do I do..If I'm listing the integers between ..remember.. What is an integer first of all?	PQ, SCQ	
Learners	L: Is minus.. um [another learner but in] is negative and positive[another learner pipes in]		vr
Teacher	E: Including?	SCQ	
Learners	L: Naught		c

Teacher	E: Including Zero ...including... say again?	SCQ	
Learners	L; Including whole numbers.		c
Teacher	E: Right and rememberintegers are negative numbers as well...	SCQ	
Learners	L: Minus 1		c
Teacher	E: oh...first of all, what is a composite number?	SCQ	
Learners	L: Uhm... Opposite number of er...er...er[Other learners chime in inaudible]		e
Teacher	E: O.K., What is a prime number?	SCQ	
Learners	L: 5 and something like that.		c
Teacher	E: I mean.. just give examples of composite numbers, Then you just write 4,6,8,10,12, and all those other things, right? All those other composite numbers right, and if I ask one of the questions [Swallows her words]...	PQ, SCQ	
Teacher	E: what is a positive number? Look at the number line again. What....	SCQ	
Learners	L: All the stuff on the right.		c
Teacher	E:All those things going that way are positive numbers isn't it?	PQ	
Learners	Class: Yes Miss.		y
Teacher	E; ... um that are positive and rational, and what is a rational number?	SCQ	
Learners	L: Numbers that are...[Another learner shouts out] 3,7,9..[Another learner says]...that are...[indistinct]		vr
Teacher	E: Do we get that?	SCQ	
Learners	L: So we must just write if it is like.. positive numbers we must just write a 6 and a comma after that.		e
Teacher	E: A negative number for example one with a positive fraction?	SCQ	
Learners	L'S: [2 of them] Yes...like a $\frac{1}{2}$		y e
Teacher	E: Like so?	PQ	
Learners	L: Can ther be lke that ...must it be...		e
Teacher	E: I 'm asking you to give me three examples of any positive uhm positive rational numbers. That was the question right? ..are you with me?	PQ, PQ	
Learners	L'S: No. Not really. Not really Miss. Almost there Miss.[All at the same time]		n
Teacher	E: Do you see the number line here.?	PQ	
Learners	L: Yes Miss[more than one learner]		y
Teacher	E: Right you see negative...	PQ	
Learners	L'S: Yes Miss [More than one learner]		y
Teacher	E: Isn't it?	PQ	
Learners	L: Yes Miss.		y
Teacher	E: Do ... do you get it now? Can you see the difference? [Learners interject]	PQ, PQ,	
Learners	L: There is a $\frac{1}{2}$. Miss..[another learner interjects]		c
Teacher	E: ...then you talking about something.....Do you mean like....do you mean like for example 2 plus $\frac{1}{2}$?	SCQ	
Learners	L: No Miss .. I'm not talking about[more learners get into the conversation....[difficult to transcribe]		n, ncb
Teacher	E: this here can be an integer, but it can also be a natural number and it can be a whole number isn't it? Whole numbers are all numbers. From zero up isn't it?	PQ, PQ	
Learners	Some L'S: Yes Miss.		y
Teacher	E: Why are you talking? Somebody's talking[Someone...Kurt Miss]	PQ	
Learners	L: Nobody's talking Miss.[another learner repeats] nobody's talking.		ncb
Teacher	E: So do we understand the difference between a rational number and an		

	integer? Integers are just whole numbers, rational numbers has fractions as well....		
Learners	L: [Speaking to classmate faintly]	PQ	ncb
Teacher	E: Not the factors[one or two learners also speaking] of 6, the multiples of 6: [learners still talking]	SCQ	e
Teacher	E: What we say about non recurring numbers?	SCQ	
Learners	L: It's irrational numbers.		e
Teacher	E: Immediately when I look at this set of numbers nuh and I ask you what are the natural numbers. What would you say?	SCQ	
Learners	L: 5		c
Teacher	E: Only 5? Only 5?	SCQ, SCQ	
Learners	L'S: 5, 2, 7, 5, 5 and miss 3, 5, 1		c
Teacher	E: What are the natural numbers here...keep in mind what is a natural number	SCQ	
Learners	L'S: 5, 1, 5, 2, 11 [Others shouting....inaudible]		c
Teacher	E: Natural numbers are numbers are <i>mos</i> just 1 and up isn't it?	SCQ	
Learners	L'S: Ja. It's wrong.		c
Teacher	E: So, of these numbers...which are the natural numbers?	SCQ	
Learners	L: 5, 5, 5		c
Teacher	E: Only 5	SCQ	
	CL: [Talking together]		c
Teacher	E; O.K. Anyway what is a whole number?	SCQ	
Learners	L'S: 0 and 50 and 5[someone else 0, 1, 2, 3]		vr
Teacher	E: So what examples of naw... of a whole number	SCQ	
Learners	L: 0 and 5		c
Teacher	E: Now I'm	SCQ	
Learners	L: 0 and 5, 0,5[others shouting]		vr
Teacher	E: right, so we said this is a whole number... and examples of whole numbers are?.....	SCQ	
Learners	CL: 0 and 5.		c
Teacher	E: In this case 0 and 5. right?	PQ	
Learners	L: And 5.		c
Teacher	E: ...what are integers here[waves across board]	SCQ	
Learners	CL: -4 and -6		c
Teacher	E: Right. So my integers are....		
Learners	CL: 5, -4, -16	SCQ	c
Teacher	E: Are that the only ones?	PQ	
Learners	CL: Yes Miss.		y
Teacher	E: Are all rational numbers already so, we write our 5 down, our 0...sorry..and what is it? -4, and -6 right	SCQ	
Learners	L: Miss		
Teacher	E: Positive numbers zero including....	SCQ	
Learners	L: 0		c
Teacher	E: No wait what we...where we now?...where we now....anyway,	PQ, PQ	
Teacher	E: we got it already. Is that it?	PQ	
Learners	CL: Yes Miss.		y
Teacher	Right?	PQ	
Learners	L: 0,5		c

Teacher	E: And what else?	SCQ	
Learners	CL: [Shouting out] 0 and there is 5 miss		c
Teacher	E: And what else?	SCQ	
Learners	L: Miss that...[another learner] 2over 7		c
Teacher	E: O.K. now how do we know that these are....are....are...are....are...irrational numbers? How do we know that?	IQ	
Learners	L; They continue.		e
Teacher	E: Right, and then you work out square root of 5...do you get such a number?	SCQ	
Learners	CL: Yes ..25 ..yes miss...[indistinct] non recurring numbers... yes.		y e
Teacher	E: Now those people who didn't fill in this part of the test, do you see now what to do?	PQ	
Learners	L: Yes Miss; Yes Miss; Yes Miss		y
Teacher	E: $x 5 \times 5 \times 5$ is the same as 5 to the power of 4, and what do we do with our exponent?		
Learners	L: You add them.		e
Teacher	E: What is it?	SCQ	
Learners	L: 5		c
Teacher	E: [Above the noise] What's this now?	SCQ	
Teacher	E: This answer?	PQ	
Teacher	E: Then you add the exponent because your bases are the same...so $10 \text{ plus } 5$ is what?	SCQ	
Learners	L; 25		c
Teacher	E: 25... That's it...	SCQ	
	[someone says] oh!		ncb
Teacher	E: And one to the power of 25 is what?	SCQ	
Learners	L: Umm... 25!		c
Teacher	E: You not sure... what is 1 to the power of 25?	SCQ	
Learners	L: 1..1 ..5		vr
Teacher	E: 1 to the power of 25?	SCQ	
Learners	L'S: 1...25...25		vr
Teacher	E: 1 to the power of 25?	SCQ	
Learners	CL: 1...25[someone says] $1 \times 1 \times 1$ [Another shouts the same] $1 \times 1 \times 1$ [others carry on] 1×1		c
Teacher	E: And what is 1×1	SCQ	
Learners	All: 1		c
Teacher	E: Times 1	SCQ	
Learners	CL: 1		c
Teacher	E: Times 1	SCQ	
Learners	CL: 1		c
Teacher	E: 1 times. So?	SCQ	
Learners	CL: [Shouting]		c
Teacher	E: O.K. And another thing..ummm..another thing...Did you sort out whose gonna be the M.C. for the...	PQ	
Learners	L: Me Miss...Me Miss		ncb