

**GENDER DIFFERENCES IN MATHEMATICS ACHIEVEMENT: AN
EXPLORATORY STUDY IN A PRIMARY SCHOOL IN
KWAZULU-NATAL**

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A dissertation submitted in partial
fulfilment of the requirements for the
degree of

**Master of Education
(Social Justice in Education)**

**UNIVERSITY OF KWAZULU-NATAL
PIETERMARITZBURG**

JANUARY 2010

ACKNOWLEDGMENTS

I wish to record my thanks to:

The learners who willingly and enthusiastically shared their teaching and learning experiences with me,

The principal, for support and allowing me to conduct the study at the school

My supervisor, Professor Nithi Muthukrishna, for her patience, kindness and constructive criticism,

My family, especially my children, Gugu, Thando, and Musa for their support and understanding during my period of study.

DECLARATION OF ORIGINALITY

I, Carol Bongi Kwela, declare that the work contained herein has not been submitted for a degree at any other institution and that unless specifically indicated to the contrary in the text; this dissertation is the original work of the writer.



C B T Khwela

20 February 2010

Professor A. Muthukrishna (Supervisor)

ABSTRACT

The study, conducted at a rural primary school in KwaZulu-Natal, explored the issue of the gender gap in Mathematics performance in Grade 6. More specifically, it examined whether there was a significant gender gap in Mathematics achievement, as well as the nature of the gender gap. The study also investigated factors associated with the differential performance of girls and boys in the Mathematics class. Learners' ages ranged from eleven to fifteen years. This study adopted a mixed methods approach. Quantitative data was drawn from Grade 6 Mathematics achievement test results conducted in 2008 and 2009. In addition, individual semi-structured interviews and focus group interviews were conducted with eight Grade 6 learners (four boys, four girls) from the 2009 Grade 6 Mathematics classes. The findings in the study reveal a gender gap in Mathematics achievement in favour of girls. The study pointed to key factors associated with the gender gap which include the issue of boys and masculinities, the dynamics of classroom cultures, and the differential attitudes to learning in respect of boys and girls in the Mathematics class. The small scale study has implications for further research in this area, and for teacher professional development.

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CHAPTER ONE: BACKGROUND TO THE STUDY

1.1 Introduction

According to Marshall & Marshall (1999) gender is an acquired identity and is learned through culturally specific socialization. Children learn gender identity through the primary socialization processes at home, through the media, the toys they play with and books that they read. Children arrive at school with specific ideas of gender appropriate behaviour and attitudes. Studies have found that schools, through their organizational structures, formally and informally, reinforce these gender stereotypes (for example: Francis & Skelton, 2005; Witt, 2000). These gender behaviours and attitudes, acquired through socialisation processes, may impact on academic achievement.

Frosh, Phoenix & Pattman (2002) who undertook research in schools in London, United Kingdom, found that boys were slipping behind girls in terms of academic achievement. Many boys in their study explained that they were faced with contradictions in negotiating masculine identities and school-work. The major reason for this was that popular masculinity was constructed as contradictory to being seen to work hard academically. According to Frosh, Phoenix & Pattman (2002) popular masculinity is pervasive in eleven to fourteen years old boys. It is characterized by toughness, playing football, showing prowess and authority and doing very little schoolwork. Schoolwork was regarded as being a female thing. Girls in the study were found to have a confident, positive attitude towards education.

Frosh, Phoenix and Pattman (2002) argued that popular boys construct their masculinities by having a joke and a laugh in relation to adult authority and classroom learning. This is part of an oppositional culture around which high status could be constructed. Commitment to work was, in contrast, feminized. Popular boys constructed girls as lacking a sense of humour and being more serious, since they were more committed to schoolwork and less interested in having fun. The gendered oppositions these boys construct result in tensions between commitment to academic work and play. This is evident in behaviours such as skipping classes, engaging in inappropriate laughter and talking in class - behaviours used to break the monotony of academic work.

Epstein, Elwood, Hey & Maw (1998) found that the most damaging forms of masculinity, that is, hierarchal heterosexuality and traditional masculine behaviours, as well as a macho culture, has gained power over the lives of some boys in schooling contexts in the United Kingdom. These forces underlie the discourse of underachievement of boys. In a similar vein, Connell (1987), drawing from his research in Australia, suggests that there is a male culture which condones an anti-school ethos and inhibits academic success. While girls listen more, get down to work and seldom backchat to teachers, boys have to be macho. In Connell's study many boys stated that they often overruled soft teachers and this made them popular. Popular masculinity is pervasive amongst eleven to fourteen year old boys, and results in the display of resistance to teachers and the education system. Connell found that boys did worse than girls in schoolwork and examination results. Girls had a confident and positive attitude towards education whilst boys needed to be pressurized into doing work. Connell found that boys thought that acting the fool in class was being macho.

In the present *small scale* study, I explore the question of a gender gap in academic achievement at a rural primary school in KwaZulu-Natal.

1.2 Focus and Rationale

I am currently a teacher at a primary school in the Umbumbulu West Circuit in KwaZulu-Natal. Over the years, my colleagues and I have become concerned about the low academic achievement of boys in comparison with girls in some of the learning areas. Teacher perceptions at the school are that girls tend to be more committed and studious learners whereas boys seem uninterested in the school work, and present various behaviour problems. Teachers have observed that boys do not return to class after the main break, they walk around the school premises during class time, stand outside their classroom creating a disturbance, and often encourage other students to join them in their misdemeanours. I have become increasingly concerned about these learners. I therefore made the decision to explore the gender gap and investigate whether particular forms of masculinities operate in this schooling context. I also examine factors that may be associated with this gender gap. My focus is on the learning area, Mathematics. I am a Mathematics teacher at the school.

1.3 Research Questions

The key research questions are:

Is there a gender gap in Mathematics performance in Grade 6 at the school? What is the nature of this gap?

Do particular forms of masculinity play themselves out in the Mathematics class? If so, how do they impact on the academic performance of boys in Grade 6?

What other factors are associated with the differential performance of girls and boys in the Mathematics class?

1.4 Structure of the dissertation

Chapter 1: The aim of this chapter is to describe the context of the research, the focus and rationale, as well as the research questions explored in the study.

Chapter 2: This chapter presents the review of related literature emanating from studies internationally, and the conceptual framework that underpins the research.

Chapter 3: After presenting a brief discussion on the methodological approach to this study, the methods used to gather data are presented. Insight into the research site, sampling techniques employed, design choices, data analysis approach and ethical issues pertinent to this study are then presented.

Chapter 4: The major research findings are discussed in this chapter.

Chapter 5: This chapter presents the conclusion and implications of this study.

CHAPTER 2: LITERATURE REVIEW

2.1 Introduction

This chapter will, firstly, examine current debates with regard to the gender gap in Mathematics performance, and secondly, explore the factors associated with the differential performance of boys and girls in Mathematics internationally. It will then review literature on gender, masculinity and academic performance in Mathematics. The notion 'masculinity' will be discussed as it provides a conceptual framework for an aspect of the study.

2.2 The 'gender gap' in Mathematics achievement: a contested issue

Much has been written about gender and academic performance in Mathematics. There have been studies conducted in countries of the North that have shown that boys performed better than girls in Mathematics (Kaiser-Messmer, 1994; Fennema, 2000). Fennema (2000) in her study showed that gender differences existed in learning complex mathematical tasks in middle and secondary schools in the United States of America. Fryer and Levitt (2006) found that the recent United States of America gender gap in Mathematics not only existed in the early elementary school years but had also grown in each grade. Fennema, Carpenter, Jacobs, Franke & Levi (1998) and Horne (2003) found that although achievement tests showed no significant difference in achievement outcomes, there have been differences shown in thinking. Both these studies were conducted with children in grades 1 to 3 and showed that in addition and subtraction, girls used counting strategies while boys were more likely to move to more sophisticated strategies. Lokan, Greenwood & Cresswell (2001) cited in Vale (2009) found gender differences in responses to some types of questions, such as the amount of interpretation of diagrammatic information.

In the past two decades or so, there has been an alternate body of research that has shown that the gender differences in mathematical performance are diminishing (Hyde, Fennema & Lamon, 1990; Frost, Hyde & Fennema, 1994). Perie, Moran and Lutkus (2005) found that the gap has been narrowing in the United States of America for the last several decades

Attention must be drawn to the fact that much of the research on this issue has emerged from countries of the North. However, an interesting study by Ming (2008) on gender and Mathematics achievement in China and the United States of America showed that there were no differences in either the United States of America, or China in eighth grade Mathematics achievement test scores. However, in both the United States of America and China, there were gender differences evident among the top Mathematics performers on college entrance examinations in that boys were over-represented.

Research in Australia indicates that gender differences in Mathematics achievement are reducing and shifting (Forgasz, Leder & Vale, 2000). The Trends in International Mathematics and Science Study (TIMSS) study, at middle primary school (age 9), showed that in most countries there were no significant gender differences in performance (Mullis, Martin, Fierros, Goldberg & Stemler, 2000). This was also the case in Australia and New Zealand at junior secondary school (age 13). However, there is strong evidence in Australia that the poor performance of particular groups of girls and boys is related to low socio-economic status (Collins, Kenway & McLeod, 2000; Teese, 2000). During the primary school years (Grades 0-6), state-wide and national testing in Australia generally found no gender differences favouring boys (Collins, Kenway & McLeod, 2000; Doig, 2001). Vale (2009) found that many studies conducted between 2000 and 2004 in Australasia showed *no significant* differences in achievement in Mathematics between males and females, though males were more likely to obtain higher mean scores. Further, findings favouring females were evident more often in studies of primary students' achievement, particularly in New Zealand. Findings that favoured males occurred in studies conducted at secondary school level.

An interesting body of international literature suggests that the gender gap in Mathematics achievement needs to be re-examined, as female learners perform better than male learners in primary schools (for example: Arnot, David, & Weiner 1999; Hydea, & Mertz, 2009). Studies done by Arnot, David & Weiner (1999) in London noted that female learners' achievement in Mathematics increasingly showed that the gender gap was closing. Female learners were viewed as doing very well in Mathematics classes. This suggests that male learners and not female learners perform poorly in Mathematics.

Hydea & Mertz (2009) and their team report a large scale study in the United States of America on gender and Mathematics. The team acquired Mathematics scores from state examinations conducted annually under No Child Left Behind (NCLB), in ten states and involving seven million students. When averaged across these ten states, the study shows that gender differences in performance are close to zero in all grades, including high school. When analyzed by ethnicity, the same pattern of gender similarities is found for all ethnic groups studied, that is, African Americans, Latinos, Asian Americans, American Indians, and Whites.

Thus, research shows that girls have now reached parity with boys in Mathematics performance, including at high school where a gap existed in earlier decades in the United States. Furthermore, girls are doing better than boys even for tasks that require complex problem solving.

There has been limited research on the issue that has emanated from the African context. In Nigeria, gender-achievement studies include Abiam and Odok (2006) who found no significant relationship between gender and achievement in number and numeration, algebraic processes and statistics. These researchers, however, found the existence of a weak significant relationship in Geometry and Trigonometry. Bassey, Joshua & Asim (2007) in their study in a rural secondary school in Nigeria involving 2000 students found a significant gender gap in favour of rural males as well as among low socio-economic students. A study by George (1994) compared gender differences in Mathematics achievement in two sub-Saharan Africa cultures (Swaziland and Nigeria) using data from the second TIMSS study. In all mathematical areas (Arithmetic, Algebra, Geometry, Statistics and Measurement), achievement distribution scores were similar for males and females in the two countries. An exception was Geometry and Algebra in Swaziland.

The International Institute for Educational Planning, UNESCO (2004) reported on the analysis of the results of the Second Southern and Eastern Africa Consortium for Monitoring Education Quality (SACMEQ) survey (2000-2002) that involved fifteen Ministries of Education. The data collected during this survey covered over 40,000 pupils, about 5,300 teachers, and 2,300 primary schools in the sub-region. The survey assessed student performance in Mathematics and Reading in Grade 6. The findings showed that in

Mathematics, girls scored significantly higher than boys *only* in Seychelles. On the other hand, in Tanzania, Kenya, Mozambique, Zanzibar, and Malawi, boys scored significantly higher than girls. In the other school systems, including South Africa, the differences were not significant. This analysis also explored factors associated with student performance.

The HSRC (2004) reported some findings on the Trends in International Mathematics and Science Study (TIMSS) in South Africa. The TIMSS studies were conducted in South Africa in 1999 and 2003 and tested learners at the Grade 8 level in Mathematics and Science. In respect of gender differences in performance, girls and boys performed almost equally. TIMSS 1999 scores revealed that there was no gender difference in national performance but there was a difference in performance of girls and boys in schools that enrolled only African learners. In the TIMSS 2003, there was no gender difference in any of the groups.

The above review suggests that recent research has shown that the achievement gap has been reduced in many countries, but that there are still areas of concern. It also suggests that the gender gap in Mathematics perceived to exist between girls and boys is a contested area in research. I have not been able to locate any large scale studies in South Africa that have examined the gender gap in Mathematics. Studies on gender and Mathematics in South Africa have focussed mainly on factors associated with differences in performance and differences in attitudes of male and female students towards Mathematics (for example: Mahlomaholo & Sematle, 2005)

In the next section, I examine what the literature indicates about factors associated with the gender gap in Mathematics achievement.

2.3 Factors Associated with Gender Differences in Mathematics Achievement

Researchers internationally have undertaken studies in various contexts that aimed at trying to examine factors that influence gendered achievement in Mathematics. Weaver-Hightower (2003) explains that much of this research over the years focused on understanding the function of gender in educational contexts, in particular, the processes that affect female entry into and success in Mathematics. Many studies have focused on factors related to differences in the performance of boys and girls in Mathematics (for

example: Abiam, & Odok, 2006; Mahlomaholo & Sematle, 2005; Opolot-Okurut, 2005; Zhu, 2007).

One body of research comes from feminist researchers who have tried to make meaning of the experiences of girls and boys in the mathematics classrooms, and to interpret male-female power relations (Jungwirth, 1991; Walden & Walkerdine, 1985). These findings reveal that often girls are marginalised and given a subordinate status in the Mathematics class. The findings also suggest that perceptions of teachers are that girls' performances in Mathematics are dependent on rote learning, hard work and perseverance rather than natural talent, flexibility and risk taking which are the learning styles of boys. Teachers are also of the view that girls "learn" Mathematics whilst boys "know" Mathematics. The studies argue that hegemonic masculinity is played out in Mathematics classes in that the behaviour of some boys negatively impacts on the ability of girls to learn, and those girls who perform well in Mathematics experience the Mathematics class as outsiders.

Other studies have looked at the attitudes of boys and girls as a factor that impacts on the differences in Mathematics performance. In a study by Opolot-Okurut (2005) it was found that for all the attitudinal variables (anxiety, confidence and motivation), males had higher mean scores than females. The study on Mathematics by Marope (1992) cited in Kaino (2001) in Botswana junior secondary schools showed that girls had more negative attitudes towards Mathematics than boys. Mutemeri & Mygweni (2005) argue that the idea that Mathematics is for boys may result in low motivation in girls and could widen the gender gap in Mathematics achievement in favour of boys.

According to Fennema and Leder (1990) gender differences in Mathematics teaching, learning and achievement have been explained on the basis of gender differences in cognition and brain lateralization. In a similar argument, Paechter (1998) argues that male and female learners do experience the world in different ways. Firstly, because, as explained above, they are differently positioned in society and secondly, because of their different learning styles and how they perceive and process reality. In the classroom, female learners prefer to use a conversational style that fosters group consensus and builds ideas on top of each other. The interrelationship of the thoughts and actions is paramount. Male learners learn through argument and individualistic behaviour that they have

developed. These researchers emphasize that most Mathematics classroom discourse is organized to accommodate male learning patterns, hence their high achievement in Mathematics. These differences have implications for the kind of instructional procedures that are to be adopted for setting up an appropriate teaching and learning environment for Mathematics instruction that is suitable to both genders.

There have been studies that suggest that teachers and schools structure the teaching and learning of Mathematics to place boys at an advantage. Koelher (1986) cited in Fennema and Leder (1990) reported that teachers treat male and female learners differently and the treatment favours male learners. According to Jones and Jones (1989) cited in Jones and Smart (1995) teacher perceptions of and attitudes regarding gender differences and gendered expectations of learners affect classroom interactions. Teachers often promote gender stereotypes and perpetuate the gender divide in subtle ways. Many teachers, especially males, view Mathematics as a male domain and convey this attitude both directly and indirectly to learners. For example, a study conducted by Hallina and Sorensen (1987) cited in Basow (1992) showed that teachers were more likely to assign male learners who scored high marks on Mathematics achievement tests to the high ability Mathematics group than they were likely to assign high ranking female learners to such a group. Female learners did not only receive less encouragement than male learners but also seemed to have a lower rate of teacher feedback than male learners. “Walden and Walkerdine (1985)”, drawing on their research in the United Kingdom, found that female learners were considered the ‘conformist plodders’ who were seen by teachers as achieving through hard work. In contrast, male learners were viewed as lazy, requiring more encouragement to get involved in educational work but, naturally ‘talented’. They were constructed by many primary teachers as possessing greater academic abilities than female learners. Leder (1992) also found that teachers were generally more helpful to male learners, encouraged them more, and generally created the impression that male learners were more Mathematics orientated than female learners.

Classroom interaction has emerged as a factor in explaining the gender gap in Mathematics (Jungwirth, 1991). These studies have found that boys’ use of verbal and non-verbal language tends to command more of the teacher’s time in both attention and

classroom control. Furthermore, boys are more mobile in the classroom than girls, and this tends to influence some teachers' beliefs that boys are more competent than girls.

Curricular materials used in the schools have also been singled out as an influencing factor in the study of Mathematics. For example, in some textbooks women are portrayed as insignificant or invisible as compared to men who dominate texts, and are referred to as pioneers and great scientists "(Abraham 1989)".

These studies suggest that teachers may destroy the confidence of learners if they do not encourage them equally in the Mathematics classroom. Learners develop a more positive attitude towards Mathematics when teachers are supportive, equitable, friendly and helpful to both genders.

Contrary to these findings, Randall (1987) cited in Epstein, Elwood, Hey & Maw, (1998) discovered that female learners receive more attention from teachers than male learners. They also found that female learners' contacts with teachers were mainly about seeking help and encouragement. It was also found that teachers' acceptance of female learners' low self-confidence in Mathematics classrooms served as reinforcement for feelings of helplessness.

Forgasz and Leder (1996) found that observed teacher and peer behaviours, the nature of learning activities and assessment tasks, and an emphasis on competition, explained gender differences in Mathematics. Boaler (1997) has shown how the different learning goals of girls and boys leave girls at a disadvantage in competitive environments. Boys and girls preferred a Mathematics curriculum that enabled them to work at their own pace as their reasoning was different. Girls valued experiences that allowed them to think and develop their own ideas as their aim was to gain understanding. Boys, on the other hand, emphasised speed and accuracy and saw these as indicators of success. Boys were able to function well in a competitive environment of text-book based Mathematics learning.

Other important factors that emerge in research on gender and Mathematics are cultural and family influences, socio-economic status of parents, and cultural and traditional influences (Ngemeza, 1991 cited in Kaino & Salani, 2004; Duncan, 1989; Finn, 1980). Such factors could influence girls' performance and subject selection in respect of Mathematics. Learners develop clear ideas about their differences in general, and about

what is perceived as gendered styles of learning in Mathematics, in particular. Studies conducted by Sleeter and Grant (1994) in the United States of America recognized that primary school cultures make it easier to entrench differences. Collins, Kenway & McLeod (2000) argued that schools establish symbolic oppositions between male and female learners through gendering of knowledge and defining of certain subjects as masculine, for example, Mathematics. In contrast, female learners are conditioned in society to believe that Mathematics is a male subject, and it is acceptable for them to drop it. Tartre & Fennema (1995) noted that female learners believe that Mathematics is a male domain, and that this view correlates with their achievement.

Studies done in Botswana by Finn (1980), Duncan (1989), and Marope (1992) cited in Kaino (2001) indicated that cultural expectations of society could result in differences in performance between girls and boys in certain school subjects such as Mathematics. Such expectations could even influence occupational choices between the two sexes. In Nigeria it has been argued that nurture entrenches male dominance over the female gender (Bassey, Joshua & Asim, 2007). Sex-stereotyping is pervasive from birth. Society fixes gender roles and conditions males to engage in intellectually and physically more challenging tasks like construction, football, palm-wine tapping, agriculture and fishing. In contrast, females are relegated to the kitchen and domestic chores. As a result of this kind of gender stereotyping, female students in the school tend to select subjects such as Home Economics. Biology, Chemistry, Physics and Mathematics are seen by girls as subjects exclusively for males.

In an interesting article, Ming (2008) explains that contextual factors such as the Chinese National Mathematics Curriculum, well-trained teachers, beliefs by students and their parents that academic achievement is more a product of effort than of natural ability, helps address the issue of a gender gap in Mathematics. Gender-neutral parental expectations for children's education and generous family spending on the education of girls are possible factors that impact the comparable performance of Chinese female and male students.

Summary: Many factors associated with the gender gap have been explored and studies reviewed above have generally confirmed the existence of gender differences. Issues such as classroom interactions, students' attitudes, students' interest and self-esteem, teachers' gendered attitudes, curricular materials and social and cultural issues have been fore-grounded to explain the extent to which they could contribute to the gender gap.

2.4 Conceptual framework of the study

I have chosen to use the concept 'masculinity' to frame an aspect of my study. This is particularly when looking at possible factors associated with the gender gap in Mathematics. The literature I have reviewed suggests that the foundations of masculinity are laid in boyhood, that is, in boys' experience of family, school, community, and peers.

Society expects males and females to behave in a particular manner based on the beliefs, practices and norms of the society (Morrell, 2001; Skelton, 2001). These expectations are learnt largely through the family, schools, churches, and other institutions. These expectations continue to define order and entrench what is considered acceptable behaviour for both male and female learners. The identity of a boy is most often bound up with the image of a father, and his status in the home and in the community (Morrell, 2001; Skelton, 2001). A patriarchal bond soon forms between father and son, and through this bond masculine power is affirmed. According to Morrell (2001) masculinities, that is, an idea of what it means to be a man, are fluid and socially and historically constructed. Masculinity is not inherited or acquired. It is constructed in the context of the class, race, school and other factors. It is therefore conceivable, as Morrell (2001) has interestingly pointed out, that females can hold power over males and others in their social setting.

Scholars in the field have argued that a key factor associated with female learners' oppression and subordination is the issue of masculinities and the construction of related male identities. "When a child enters school different types of masculinities are produced and played out". Different forms of masculinity emerge as hegemonic in different schools. Skelton (2001) explains that young children construct their masculinity and adapt them to suit the particular social contexts within which they are located. Weaver-

Hightower (2003, p. 480) explains that this notion of multiple masculinities suggests that “individuals and social groups create and adapt versions of masculinity for their own uses within their own cultural frames.” In other words, they adopt multiple subject positions. These multiple forms of masculinity struggle for dominance. Some groups achieve this dominance (Weaver-Hightower, 2003).

My research aims to explore gender and masculinity in order to understand the observed gender gap at the research site, a rural primary school. Skelton and Hall (2001) contend that male and female learners in primary schools in the United Kingdom are actively involved in the construction and maintenance of their gender identities. These scholars explain that girls and boys develop a wide range of gendered ways of thinking and behaving. They actively rehearse and explore them - continually developing and adapting them to fit their own social worlds.

Millard (1997) suggests that there are often contradictions in the kinds of gender relations reinforced in learners by schools, parents, families, and the wider community. Thus, learners are caught in overlapping gender regimes – those of the community, peer culture and the school. Schools may try to confront and challenge external regimes but these regimes are often entrenched and may affect learner achievement - especially those of male learners.

2.5 Gender, masculinity and achievement in Mathematics

Numerous studies have examined the links between masculinity, gender and Mathematics achievement. Much of this literature has examined the issue of boys' performance in Mathematics, and its link to the notion of masculinities.

Kimmel (2000) explains that the issue of masculinity is not the problem of male versus female learners. It is about rigidly constructed gender roles and stereotypes that negatively impact both genders. He suggests that boys' general view of their "expert" status (a masculine privilege) makes them overconfident and, this overconfidence contributes to a lack of engagement with school subjects and inadequate preparation for tests and examinations. Bringing the concept of masculinity into the discussion of the subjects such as Mathematics can help challenge stereotypes.

Studies done by Tartre and Fennema (1995) in the United States of America note that female learner beliefs that Mathematics is a male domain, are reinforced by interactions in the classroom. There is a tendency for males to oppress, demean and harass female learners. This results in female learners feeling nervous and intimidated, and this negatively impacts on their classroom performance. Murphy and Gipps (1996) confirm this by showing that in the United States of America and Australia female learners of all ages experience a degree of harassment and hostility in their classroom interactions with male learners. This has a negative impact on female learners' academic achievement.

Frosh, Phoenix and Pattman (2002) in their studies in the United Kingdom found that male learners were gradually slipping behind female learners in terms of Mathematics academic achievement. These researchers attribute this to the ways in which cultural expectations such as notions of invulnerability, daring and aggression influence boys' views of schooling. They argue that popular masculinity has a negative effect on the achievement of males. Male learners act foolishly in the classroom to show that they are real men, and demand the educators' attention. However, they stress that one must not ignore the fact that all masculinities are not created equal. One culture may define what it means to be a man in contrasting ways to other cultures.

Jackson (2003) in her study found that some male learners constructed their masculinities in ways that challenged school masculinities. This resulted in behaviours such as aggressiveness towards other male and female learners who do well in Mathematics. Male learners viewed good performance in Mathematics as feminine and of low status, and distanced themselves from anything viewed as feminine. Renold (2001) shows how the discourses of hegemonic masculinity operate to shape and form boys' learner identities in the schooling context. She examines ways in which boys negotiate the tensions between the perceived feminisation of academic success and the need to project a strong hegemonic masculinity. She found that there are pressures of hegemonic masculinity upon high-achieving boys.

Francis (2006) criticizes the current discourse on male learners' underachievement in Mathematics and explains that it hides far more critical differences in educational achievement related to poor socioeconomic background of learners, geographical locale,

cultural and ethnic differences as well as race and social class. Francis (2006) stresses that we need to take into account differences amongst boys and girls, as well as differences between girls and boys.

2.6 Conclusion

The literature reviewed has focussed on debates with regard to the gender gap in Mathematics. It has examined factors associated with the gender gap, including the issue of masculinities.

The next chapter outlines the research methodology in this study and the design choices made.

CHAPTER 3: RESEARCH METHODOLOGY AND DESIGN

3.1 Introduction

The study conducted at a rural primary school in KwaZulu-Natal explored the issue of the gender gap in Mathematics performance in Grade 6. This chapter will introduce the research methodology and design adopted in the research project. The reasons for design choices will be outlined.

3.2 Research Methodology

This small scale study adopted a mixed methods approach. It involved the use of a combination of quantitative and qualitative approaches for the study. Creswell (2008) describes mixed methods research as an approach of collecting, analyzing and combining both quantitative and qualitative data at some stage in the research process within a single study. A mixed methods approach is therefore an attempt to use multiple methods to answer the research questions. It depends on the presentation of facts through words (qualitative) and statistical results represented with numbers (quantitative). In this small scale study, I sought to *understand* a research problem in greater depth (qualitative) and breadth (quantitative) which is an advantage that a mixed methods approach offers (Burke Johnson & Onwuegbuzie, 2004).

A mixed methods approach enables triangulation. In the case of my study the aim was not to corroborate evidence for the sake of validating the conclusions drawn. The aim of using a mixed methods approach was not to enable validation as I wanted each data source to be understood on its own terms (Bazeley, 2002). My study did not assume a single reality. I wanted the research issue to be understood in different ways and I therefore sought to examine different ways of experiencing and knowing my participants (Bazeley, 2002).

Although this was a *small scale study*, deep understanding, not validity was my goal. The study was located within an interpretive paradigm. I also felt that using different methods would help me overcome my personal biases which may be inherent in a single methodology (Bazeley, 2002).

3.3 Research Design

3.3.1 Context of the study

The site for this research study was the Makhonjwa Primary School (“pseudonym”), in rural KwaZulu-Natal. It is a local co-educational state school that was established in 1942. Learners’ ages range from eleven to fifteen years. The school offers programmes from Grade R (preschool) to Grade 7. This rural primary school is located in an underdeveloped area in Umbumbulu.

Many learners and their families come from very poor, disadvantaged backgrounds. Unemployment in the area is high. Many households in this community are headed by elderly women and families are dependant on the meagre government pension for the aged to survive. Some members of the community depend on farming, hunting and working in the nearby sugar cane farms to make ends meet. Most of the learners in this rural primary school live a long distance from the school. They walk five to ten kilometres to school everyday. The school runs a nutrition programme which provides learners with a meal each day.

3.3.2 Research participants

In the design phase of any research study an important decision has to be made about the sampling strategy to be adopted. I followed a purposive sampling method in the *first phase* of the study. This phase explored whether there was in fact a gender gap in the achievement of the Grade 6 learners in Mathematics at the school. Bless and Higson-Smith (2000) explain that purposive sampling has great value especially when used by a researcher who knows the population under study. The sample is therefore selected subjectively by the researcher. Cohen, Manion & Morrison (2007) explain that purposive sampling allows the researcher to select the sample according to the nature of the problem and the phenomenon being studied. The participants were Grade 6 learners from the two Mathematics classes at the school. Seventy learners participated in the first phase of the study. This phase involved analysis of Grade 6 Mathematics achievement test data from year 2008 and 2009 that involved quantitative data.

The second phase of the study was qualitative in nature. Here the aim was to examine factors associated with the gender gap, including the issue of masculinities *from*

the perspectives of learners. It involved random sampling. I selected eight (8) learners randomly from the two Grade 6 Mathematics classes, stratified by gender (2 boys and 2 girls from each class). These learners participated in individual and focus group interviews. Cohen et al. (2007) assert that in a qualitative research project the sample size should be small.

3.3.3 Data Collection Process

As explained above, in phase one data collection involved document analysis. I was able to access the Mathematics achievement test mark sheets from the school for the years 2008 and 2009. In 2008 seventy (70) learners had written the tests (29 female; 41 male). In 2009 seventy learners wrote the two tests (22 females; 48 males).

I obtained three sets of achievement test results: November 2008, June 2009 and November 2009. The aim was to ascertain whether there was a pattern in the performance of the boys and girls in Mathematics. As stated earlier the perception of teachers at the school was that girls were outperforming boys academically. The aim in this phase of the study was to ascertain whether this trend in Mathematics in favour of girls was in fact statistically significant. A limitation in this process is that I failed to obtain the June 2008 results.

In the second phase of the study, my data sources were eight Grade 6 learners from the two Mathematics classes at the school. The aim was to explore *from the perspective of learners* factors associated with the performance of learners in the Mathematics class.

3.3.3.1 Individual interviews: Semi-structured interviews were conducted with the eight Grade 6 learners from the two Mathematics classes at the school. The advantage of the interview technique is its scope for probing issues and leading pupils into an in-depth discussion about matters pertaining to the study at hand (Hart, 2005). A semi-structured interview resembles purposeful conversation usually between two people that is directed by one person in order to get information (Babbie, 2002; Cohen et al., 2007).

In this study, my aim was to see the world from the eyes of the learners. All interviews were audio-taped and later transcribed. During the interviews I used one scenario to focus and facilitate the discussion (Refer to Appendix 1).

O’Kane (1999) explains that the use of concrete situations helps to facilitate children’s participation in research. Van der Riet, Hough, Killian, O’Neill & Ram., (2006) and Van der Riet, Hough & Killian (2005) have argued that encouraging children to project onto a picture (or a scenario) enables them to be more at ease when talking about potentially stressful and stigma provoking personal issues. This process also helped to address the power dynamics between me, their teacher, and the learners. I shall discuss this in more depth in sub-section 3.3.5: Ethical considerations. However, some of the questions based on the scenarios were sensitive. They required me, as the researcher, to go beyond the emotional accounts of their experiences and feelings. I had to tease out the deeper issues that would enable me to explore the questions under study. This proved to be a challenge.

Interviews were conducted in the respondents’ own language, IsiZulu. The rationale for using the respondents’ language was to ensure that the respondents articulated their responses freely and clearly without language being a barrier.

3.3.3.2 Focus group interviews: The eight learners in this study participated in one focus group interview. Focus groups encourage communication and shared understanding especially around difficult issues, allowing for the exploration of differences as well as similarities in experiences and in thinking (Lewis, 2000). The group format of focus groups also potentially decreases the power dynamics between the researcher and the participants (Moyle, 2007). Moyle (2007) argues that focus groups enable the researcher to listen to participants, and this act of listening in itself empowers them. The researcher is not a neutral observer but engages in a relationship with the participants.

In the focus group I raised key issues that emerged in the individual interviews and also engaged learners in elaborating on issues that were raised in the individual interviews. During the focus group interviews I did experience certain challenges. For example, I struggled to take notes in the midst of the conversation. I also found transcribing the interviews a challenge as at times participants, in their enthusiasm, talked at the same time. Another process issue that challenged me was trying to deal with power relations within the group and to ensure that all learners were given space to have their voices heard.

3.3.3.3 Document Analysis: The data source for phase one of the study was school documents. The documents obtained for analysis in this study were the school's *mark sheets* which recorded the results of the Mathematics achievement tests conducted in November 2008, June 2009 and November 2009. It was possible to analyse these results by gender.

3.3.4 Data Analysis

The phase one data, results of the three achievement tests, were analysed using the SPSS statistical package. Means, standard deviations and frequency tables were produced. Data was also analysed using independent t-tests to compare scores of male and female learners.

The data from phase two of the study was analysed qualitatively. Data from the interviews were analysed qualitatively, firstly, by examining categories of responses, and then through key patterns and themes. I used a descriptive analysis technique where units of meaning were examined, categorized and then central themes were identified (Patton, 2002). I addressed the typical problems of reliability in data analysis related to subjective interpretation of data, poor coding of qualitative data and selective use of data through member check. My supervisor played an important role in this aspect of my study. Our joint reflexivity throughout the process of data analysis and interpretation proved valuable in addressing the issue of reliability. This issue is about the *trustworthiness* of the researcher's data collection and interpretation. It is also about *dependability*: are the findings dependable? (Denzin & Lincoln, 2005; Seale, Gobo, Gubrium. & Silverman, 2004).

.3.3.5 Ethical Considerations

Collecting data from the learners raise ethical concerns. I was very aware that I had to maintain confidentiality and anonymity. In order to maintain the concept of individual confidentiality and concretely demonstrate this to learners, each learner was requested to choose a pseudonym for himself/herself. These were the names used throughout the

interviews. I explained to participants that any information divulged in the individual interviews and group interviews would be recorded under the code name. The issue of power differential between participants and the researcher is particularly important when researching with children. Being a teacher at the school made the interviews even more complex as learners may have felt obligated to participate in the research even though they might not have wanted to.

I arranged a meeting with the principal of the school and the Grade six educators to explain the aim and design of the study, and to seek their consent to participate in the study. Consent letters were forwarded to the principal, learners' parents or guardians and Grade six educators (refer to appendix). The study was also explained to the learners and consent letters were given to them to complete.

All participants were informed that their participation and involvement were voluntary and at any time, should they feel uncomfortable, they had the right to withdraw from the study without prejudice to them. Consent was obtained from all participants. Teachers willingly gave permission for classroom observations to take place.

Ethical clearance was granted by the University of KwaZulu-Natal (Ethical Approval Number: HSS/0740/2009).

3.3.6 Limitations of the study

This small scale research focused only in one primary school and in one circuit of Umbumbulu West. The key participants were learners. It may be argued that it becomes difficult to generalize from a small sample such as this. I believe that the value of the study is that it may prompt other researchers to reflect on the gender issue in Mathematics classrooms and achievement patterns in other contexts. The study can be replicated in other contexts, resulting in a set of generalisable case studies replicated across a range of scenarios and sites (Flyvbjerg, 2004).

3.4 Conclusion

This chapter provided insight into the research methodology and design choices made in the study. The next chapter presents the findings in the study.

CHAPTER 4: DISCUSSION OF FINDINGS

4.1 Introduction

In this chapter, the findings, in respect of the research question: 'Is there a gender gap in Grade 6 Mathematics achievement at the study school?' will be presented. Following this, learner perspectives on factors related to the differential performance of boys and girls in Grade 6 Mathematics will be discussed.

4.2 Is there a Gender Gap in Mathematics Performance of Grade 6 Learners?

Data from the achievement test conducted in November 2008, June 2009 and November 2009 in the two Mathematics classes at the school were analyzed statistically. The results presented in Tables 1, 2 and 3 are the means and standard deviations of learner scores on each of the three tests according to gender.

These results suggest that girls have out-performed boys. T-tests were computed to ascertain whether the differences between male and female scores were significant. The results of the t-tests on the November 2009 test scores (Table 1) indicate a statistically significant difference in favour of females between the scores of male and female learners, $t(68) = 3.348, p < .01$.

The results of the t- test on the June 2009 test scores (Table 2) indicate that there is a statistically significant difference in the scores on the June 2009 Mathematics test scores between male and female learners, in favour of female learners, $t(68) = 4.285, p < .01$.

However, the results of the t- test on the November 2009 test scores (Table 3) indicate that the difference between male and female learners is not statistically significant, $t(70) = .943, p > .01$

Table 1: Descriptive Statistics: November 2008 Maths Test Scores

Test	N	Minimum	Maximum	Mean	Std. Deviation
Female	29	25.00	96.00	69.52	19.93
Male	41	13.00	95.00	50.10	17.75
Overall	70			58.14	20.90

Table 2: Descriptive Statistics June 2009 Maths Test Scores

Test	N	Minimum	Maximum	Mean	Std. Deviation
Female	22	32.00	87.00	52.41	14.74
Male	48	10.00	84.00	38.08	17.40
Overall	70			42.59	17.81

Table 3: Descriptive Statistics: November 2009 Maths Test Scores

Test	N	Minimum	Maximum	Mean	Std. Deviation
Female	22	19.00	80.00	48.05	14.07
Male	48	10.00	92.00	39.81	15.16
Overall				42.40	15.22

These findings are largely in contrast to the findings of HSRC (2004) in its analysis of the International Mathematics and Science Study (TMMS) 1999 and 2003 results. In respect of gender differences in performance, the Grade 8 girls and boys performed almost equally. TIMSS 99 scores revealed that there was no gender difference

in national performance but there was a difference in performance of girls and boys in favour of boys in schools that enrolled only African learners. In the TIMSS 2003, there was no gender difference in any of the groups. Similarly, the UNESCO (2004) analysis of results of the Second Southern and Eastern Africa Consortium for Monitoring Education Quality (SACMEQ) survey (2000-2002) showed that in South Africa, gender differences were not significant. The findings showed that girls scored significantly higher than boys *only* in Seychelles. The results of the present study are interesting, and suggest the need for larger scale studies examining the issue of the gender gap in Mathematics in South Africa.

4.3 Factors Associated with the Gender Gap in Mathematics Achievement: Through the Lens of Learners

The study obtained the perspectives of Grade 6 learners (4 boys and 4 girls) on the gender gap in Mathematics. In analysing the data, three themes were identified that linked to the research questions:

Do particular forms of masculinity play themselves out in the Mathematics class?
If so, how do they impact on the academic performance of boys in Grade 6?

What other factors are associated with the differential performance of girls and boys in the Mathematics class?

Learner responses in this study suggest that many complex factors such as social and cultural, psychological (affective) and contextual, may contribute to gender differences in mathematical achievement and performance in the Grade 6 class.

4.3.1 Boys and the issue of masculinities in the Mathematics class

As explained in chapter two, during the last decade of the twentieth century, the issue of the under-achieving boy was raised by researchers in countries of the North (for example, Skelton, 2001). Much of this literature has examined the issue of boys' performance in Mathematics, and its link to the notion of masculinities. As explained in chapter two, masculinities - an idea of what it means to be a man - is fluid and socially and

historically constructed. Frosh, Phoenix & Pattman (2002) found that many male learners in their research explained that they were faced with contradictions in negotiating their masculine identities and school work. The social pressure for gender conformity was evident. If boys engaged in academic work, they were seen to be abandoning a position of power. These researchers found that certain groups of boys constructed their masculinity in ways that contradicted school norms and values. For example, they viewed achievement as feminine and of low status. Every male learner in the primary school where Frosh, Phoenix & Pattman (2002) conducted their study felt the need to guard against being labelled a 'geek' by not being seen to work hard and by not showing openly an enjoyment of academic work.

In the present study the impact of masculinities in the Mathematics class was evident in the responses from learners. Female learners alluded to the fact that boys felt they were experts in Mathematics merely because they were boys. They were over-confident, did not concentrate in the Mathematics class and were often disruptive. The girls' responses seemed to suggest that the way boys constructed their masculinity was in opposition to the norms and values of the school norms. The following excerpts illustrate this view:

Some of the boys like to control the class, and disturb other learners and the teacher during the teaching and learning. They think they know it all. (girl, focus group interview)

Boys do not pay attention in class, they make a noise and challenge the teacher's authority, maybe that is why they do poorly in Mathematics (girl, individual interview)

They are noisy, loud and disruptive, interrupt the discussion, and try hard to disturb the teaching and learning." (girl, individual interview)

They think they are talented and that Mathematics is the men's subject (zithathwa ngesifundo sabafana..... samadoda) – so they do not have to pay attention (boy, individual interview)

They also think that if they play and backchat to the teacher, they are popular (boy, individual interview)

I think the boys do poorly because they do not do their homework. Some of the boys said that they don't like to carry their books home because they fear to be called names and mocked by other boys (girl, individual interview)

They come late to the lessons, do not do their homework, act tough and have a laugh during lessons; they are not committed to school work (girl, individual interview)

Certain learners linked the disruptive behaviour and lack of interest in the Mathematics class to cultural expectations of boys in this rural context. As discussed in chapter two, studies by Finn (1980) and Duncan (1989) indicated that cultural expectations of society could result in differences in performance between girls and boys in certain school subjects like Mathematics. Learners interviewed in the present study made reference to these influences:

"Boys in this rural community have to focus in cultural practices such as how to be the real Zulu boy in rural areas, and the school work is not important". (boy, focus group interview)

I think boys are disturbed by male models in the area, they do not do their homework. They go to older men or boys in the area to learn how to be a man we learn our culture. We often talk about this in Mathematics class..... we have our own conversation... while the teacher is teaching.... about how to get girls also.(boy, individual interviews)

Certain female learners explained that they experienced harassment and hostility in their classroom interactions with male learners. Linked to this kind of female learners' oppression and subordination seems to be the issue of masculinities, and the construction of related male identities.

I got into trouble for copying one day. This boy forced me to give him my homework book, and he copied my work. He threatened me that he will hit me after school if I did not give him the book. (girl, individual interview)

I do not like to be intimidated and made fun of by the boys during discussion in class (girl, individual interview)

Girls feel uncomfortable about Mathematics because they are afraid to be laughed at by the boys if they answered incorrectly (girl, individual interview)

One learner gave his analysis of difficulties with classroom engagement on the part of boys:

When the teacher puts us in groups, we look at the girls' faces and fall in love with them, and want to win them ... we are boys you see....., and we think about having a relationship with them.... and we forget about what the teacher told us to do.

Weaver-Hightower (2003) explains that individuals create versions of masculinity for their own uses within their own cultural frames, and these constructions are often situated in particular contexts.

4.3.2 The dynamics of mathematical classroom cultures

Sleeter and Grant (1994) recognized that primary classroom cultures can entrench differences. Collins, Kenway & McLeod (2000) argue that schools often establish symbolic oppositions between male and female learners. Chionidou (1996) cited in Chionidou-Moskofoglou and Chatzivasiliadou-Lekka (2003) conducted a study in Greece that showed that in Mathematics classes, teachers tend to direct more questions at boys than girls. Boys therefore get more opportunities to give answers, and in doing so receive more praise than girls.

Chionidou-Moskofoglou and Chatzivasiliadou-Lekka (2003) found that teachers in their study in Greece considered boys to be more talented and brighter than girls in mathematical logical thinking. They also believed that girls needed more explaining than boys because girls felt insecure to ask questions when they did not understand something. Most teachers in this study thought that female pupils tended to abandon their tasks in Mathematics when they encountered difficulties.

In the present study, learners alluded to the fact that teachers reinforced gender differences between boys and girls and the perception was that teachers did not treat boys and girls equally.

I think girls feel worried of the Mathematics teachers because they know that Mathematics teachers always take the boys' side. They are also shy and fear that they might give wrong answers and boys will laugh (girl, individual interview)

All the girls know that Mathematics teachers are more helpful to boys than to girls (girl, individual interview)

Some of the teachers do not treat boys and girls equally in Mathematics class, they take the boys' side most of the time –“ this could make girls do poorly in Mathematics (boy, individual interview)”

I think boys and girls are born with same abilities in Mathematics, only teachers who teach Mathematics make us feel that way by treating us differently (boy, individual interview)

In contradiction to the above views, there were boys in the study who felt that teachers gave more attention to girls. For example:

Boys think the teacher is in favour of girls that is why they are not doing well (boy, individual interview)

Boys think girls are doing better in Mathematics because the teachers like them, not because they are clever (boy, individual interview).

In a study in the United Kingdom, Randall (1987) cited in Epstein, Elwood, Hey & Maw (1998) also found that female learners received more attention from teachers than males learners.

Studies suggest that teachers may destroy the confidence of learners if they do not encourage them equally in the Mathematics classroom. Learners develop a more positive attitude towards Mathematics when teachers are supportive and equitable to both genders (Jungwirth, 1991).

The data also alluded to poor self-esteem and a lack of confidence in girls during participation in lessons:

I mean girls are not brave as we are in Mathematics class, they are very shy They cannot argue with or question with the teacher, they say understand even if they do not (boy, individual interview)

Similarly, teachers in a study by Chionidou-Moskofoglou & Chatzivasiliadou-Lekka (2003) stated that the reason for girls' lack of participation in the Mathematics

classes were that girls were either embarrassed or afraid that their peers would make fun of them.

The present study suggests that Mathematics achievement may be the outcome of a complex process of social construction involving the teachers' or learners' gender stereotypes or both.

4.3.3 Against the odds? Explaining the gender gap in favour of girls

As stated in chapter two, recent research has shown that the gender gap in Mathematics, perceived to exist between girls and boys, is contested in research. This is so even in studies undertaken in the African context (for example: Abiam, & Odok, 2006; Bassey, Joshua & Asim, 2007). In the present study, it is surprising that there seems to be a gender gap in favour of *girls*. I tried to examine what *learners* suggested to be the reason for girls outperforming boys in this rural school.

Both girls and boys alluded to the fact that girls tended to be more committed to Mathematics learning than boys. However, many of the boys felt that teachers favoured girls, by giving them more attention in the Mathematics class, and this is the reason girls did well in Mathematics. Girls suggested that they had different learning styles to boys, and this placed them at an advantage. Girls liked working with the other girls collaboratively to solve Mathematics problems, and sharing ideas. This is in contrast to Boaler (1997) who found that different learning goals of girls and boys leave girls at a disadvantage in competitive environments.

Girls listen and share ideas, they also like personal interaction. They tackle Mathematics concepts in groups during breaks, and together come up with solutions (girl, individual interview)

Girls pay attention to their work, they are not playful like boys do (boy, individual interview)

They like to work, they listen to the teacher, and share ideas. They like to work in groups. (girl, individual interview)

Girls listen to the teacher and focus in the Mathematics class (boy, individual interview)

After the lesson, girls stay in class. I see them giving each other Mathematics problems and they take turns and practise on the board. They even prepare themselves before the teacher teaches the lesson.

Boaler (1997) also found that girls valued experiences that allowed them to think and develop their own ideas as their aim was to gain understanding. However, the present study highlights learner perceptions that girls tended to be more committed to learning in the Mathematics class than boys. One of the boys in the study explained how his sister did very well in Mathematics despite the fact that she had various household chores to complete when she got home from school. He tried to make sense of why she outperformed him and many other students in Mathematics and alluded to the fact that she was a disciplined and committed student..

My sister has a lot of things to do when she comes home from school. She cooks, washes clothes, and fetches water. Yet she does better than me in Mathematics. I just have to collect the cows. Maybe some of us get stuck in drugs. I know she leaves to school early every day, maybe she studies in school in the morning. I do not ask her to help me, she will think she is great.

4.3 Conclusion

The findings in the study suggest a gender gap in favour of girls in respect of Mathematics performance in Grade 6. This chapter also explored factors that may be associated with this gap from the perspectives of a group of *learners* in Grade 6. The fact that the key participants were only learners points to a limitation in the study.

CHAPTER 5: CONCLUSION AND IMPLICATIONS OF THE STUDY

This study sought to explore the question of a gap in Mathematics at a rural primary school in KwaZulu-Natal. It must be stressed that this was a small scale, exploratory study. Further research would need to be undertaken to examine the trends that emerged in this study in greater depth.

Many scholars warn against attempts made by researchers to explain trends in gender differences in Mathematics from a deficit view, that is, an emphasis on fixing up the girls or boys by addressing deficit skills or attitudes (Vale, 2009). A sounder approach would be to examine situational factors that may be influencing differential performance, for example, socialization processes, classroom pedagogy, classroom cultures, teacher attitudes, parental and teacher attitudes.

The study suggests that there is a need to give boys and girls exactly the same opportunities and challenges in the Mathematics class. Teacher professional development programmes should make a more concerted effort to advise teachers about the ways in which to approach the teaching of Mathematics to avoid disadvantaging particular groups of girls or boys. Bassey, Joshua & Asim (2007) stress that Mathematics teaching and evaluation strategies should be gender bias-free. This way, males and females will tend to see themselves as equals capable of competing and collaborating in classroom activities.

Teacher education programmes and schools need to include the issue of masculinities so that teachers can learn how to get their students to challenge dominant constructions of masculinity that may negatively impact on their academic work. Court (2001) warns that masculinities should not neglect the focus on raising opportunities for girls within the school system and beyond. Male and female teachers should work jointly with boys and girls and adopt a more socially just and inclusive approach to creating equal opportunities for all learners. Finally, this study suggests that there is a strong need for research that focuses on teachers' perceptions and attitudes with regard to gender differentiations in teaching Mathematics.

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APPENDICES

Appendix 1: Scenario - Learner semi-structured interviews

In Siyafunda school in the Limpopo province, for the past three years girls and boys perform differently in Mathematics. While girls obtain an average 67% pass in Mathematics, in the case of boys the average pass rate is 32%. Teachers and parents are very worried about this, and are trying to obtain more information to help improve the performance of all learners.

Why do you think boys and girls achieve different results in Mathematics tests at this school?

The following questions will guide the probing of responses by the researcher:

Do you think boys and girls are born with different abilities in Mathematics?

What do you think teachers think of girls in the Mathematics class? Why do they have these views?

What do you think teachers think about boys in the Mathematics class? Why do they have these views?

What do boys think about girls in the Mathematics class?

What do girls think about boys in the Mathematics class?

What do parents/caregivers think about boys' performance in Mathematics?

What do parents/caregivers think about girls' performance in Mathematics?

Are there any factors in the home, and community that result in boys/girls not doing their best in Mathematics? Explain.

What factors in the school make boys do poorly in Mathematics?

What factors in the school make girls do poorly in Mathematics?

How do the boys behave and participate in the Mathematics class?

How do the girls behave and participate in the Mathematics class?

How do you think girls feel about Mathematics?

How do you think boys feel about Mathematics?

What do boys think about their own poor performance in Mathematics?

What do girls think about their own poor performance in Mathematics?

What can the school and community do to help boys do better in Mathematics?

What do you like about the Mathematics class?

Why don't you like about the Mathematics class?

How can the school and community help girls to do better in Mathematics?

Would you take Mathematics in high school?

Indikimbana 1.1: Isehlakalo __ Imibuzo ebuzwa Abantwana kwinkulamo mpendulo

Esikoleni Isiyafunda eLimopopo provinsi, eminyakeni emithathu edlulileyo abafana namantombazane baphumelela ngokwahlukana eZibalweni. Amantombazane athola 67% kwathi abafana bathola 32%. Othisha nabazali bakhathazeke kakhulu ngalokhu bazama ngazozonke izindlela ukuthola ulwazi olungabasiza ukuze imiphumela yabantwana ithuthuke.

Ucabanga ukuthi ngabe yini eyenza abantwana baphumelela ngokwahlukana ezivivinyweni zezibalo kulesisikole?

Lemibuzo elandelayo izohola umcwaningi ezimpendulweni

U cabanga ukuthi abafana namantombazane bazalwa benolwazi olwahlukene ezibalweni?

Ucabanga ukuthi othisha bacabangani ngamantombazane ekilasini lezibalo? Yini eyenza babe naleyo micabango?

Ucabanga ukuthi othisha bacabangani ngabafana ekilasini lezibalo? Yini eyenza babe naleyo micabango?

Ucabanga ukuthi abafana bacabangani ngamantombazane ekilasini lezibalo?

Ucabanga ukuthi amantombazane acabangani ngabafana ekilasini lezibalo?

Ngabe abazali noma abanakekeli bacabangani ngokusebenza kwabafana ezibalweni?

Ngabe abazali noma abanakekeli bacabangani ngokusebenza kwamantombazane ezibalweni?

Ngabe kukhona ekhaya noma emphakathini into eyenza abafana namantombazane bangasebenzi kahle ezibalweni? Chaza.

Yini eyenza abafana esikoleni bangaphumeleli kahle ezibalweni?

Yini eyenza amantombazane esikoleni angaphumeleli kahle ezibalweni?

Abafana baziphatha futhi basebenzisane kanjani ekilasini lezibalo?

Amantombazane aziphatha futhi asebenzisane kanjani ekilasini lezibalo?

Ucabanga ukuthi amantombazane azizwa zinjani izibalo?

Ucabanga ukuthi abafana bazizwa zinjani izibalo?

Bacabangani abafana ngokungasebenzi kahle kwabo ezibalweni?

Acabangani amantombazane ngokungasebenzi kahle kwawo ezibalweni?

Yini engenziwa isikole nomphakathi ukusiza abafana basebenze kahle ezibalweni?

Yini oyithandayo ngekilasi lezibalo?

Yini ongayithandi ngekilasi lezibalo?

Isikole nomphakathi ungawasiza kanjani amantombazane ukuze aphumelele kahle ezibalweni?

Ungaqhubeka uzifunde izibalo emabangeni aphezulu?

Appendix 2

2.1 Letter to School Principal Requesting Permission to Conduct research

School of Education and Development
Faculty of Education
University of KwaZulu-Natal
Edgewood Campus
Private Bag X03
Ashwood
3605
1 July 2009

The Principal
----- Primary School

Dear Sir/Madam

Re: Request for permission to conduct a research

I am presently studying for Masters in Education at the University of KwaZulu-Natal. As I explained to you at our initial meeting, I am in the process of conducting my research on the 'Gender differences and academic achievement in Mathematics'. Over the years, I have become concerned about the low academic achievement in Mathematics of learners at your school, especially the under-achievement of boys as compared to girls. I would like to investigate this issue in greater depth.

I hereby request permission to conduct research in your school. The research is for academic purposes only.

All information will be treated with confidentiality. At no stage would the name of the learners, teachers or the school be mentioned in my study.

My contact details and those of my supervisor are provided in case you might need further clarification on the study.

CONSENT FORM

I understand the nature of the study. I understand that teachers and learners will have freedom of withdrawal from the study at any time. I also understand that anonymity and confidentiality will be assured. I therefore give you permission to conduct research at my school.

Name: _____ Date _____

Sign: _____

Yours faithfully

Ms Carol Bongi Kwela

031 9068618

981174349@ukzn.ac.za

Professor Nithi Muthukrishna

031260 2494

muthukri@ukzn.ac.za

2.2 Letter to Teacher

**School of Education and Development
Faculty of Education
University of KwaZulu- Natal
Edgewood Campus
Private Bag X03
Ashwood
3605
1 July 2009**

Dear Sir/Madam

Re: Request for consent to conduct a research

I am presently studying for Masters in Education at the University of KwaZulu-Natal. As I explained to you at our initial meeting, I am in the process of conducting my research on the 'Gender differences and academic achievement in mathematics'. Over the years, I have become concerned about the low academic achievement in mathematics of learners at your school, especially the underachievement of boys as compared to girls. I would like to investigate this issue in greater depth. I hereby request your consent to participate in my study. The research is for academic purposes only.

All information will be treated with confidentiality. At no stage would the name of the learners, teachers or the school be mentioned in my study.

My contact details and those of my supervisor are provided in the case you might need further clarification on the study.

CONSENT FORM

I understand the nature of the study. I understand that I will have the freedom of withdrawal from the study at any time. I also understand that anonymity and confidentiality will be assured. I therefore agree to participate in the study.

Name: _____ Date _____

Sign: _____

Yours faithfully

Ms Carol Bongi Khwela

0319068618

981174349@ukzn.ac.za

Professor Nithi Muthukrishna

0312602494

muthukri@ukzn.ac.za

2.3 Letter to Parent/Caregiver

School of Education and Development
Faculty of Education
University of KwaZulu-Natal
Edgewood Campus
Private Bag X03
Ashwood
3605
1 July 2009

Name of Parent

Address

Dear Sir/Madam

Re: Request for consent to research with your child: Name of Learner

I am presently studying for Masters in Education at the University of KwaZulu-Natal. As I explained to you at our initial meeting, I would like to conduct research on 'Gender differences and academic achievement in Mathematics'. Over the years, I have become concerned about the low academic achievement in Mathematics of learners at the school your child attends, especially the under-achievement of boys as compared to girls. I would like to investigate this issue in greater depth. I hereby request your consent to allow your child to participate in my study. The research is for academic purposes only.

All information will be treated with confidentiality. At no stage would the name of the learners, teachers or the school be mentioned in my study.

My contact details and those of my supervisor are provided in the case you might need further clarification on the study.

CONSENT FORM

I understand the nature of the study. I understand that my child will have freedom of withdrawal from the study at any time. I also understand that anonymity and confidentiality will be assured. I therefore give permission for my child to participate in the study.

Name: _____ Date _____

Sign: _____

Yours faithfully

Ms Carol Bongi Kwela

031 9068618

981174349@ukzn.ac.za

Professor Nithi Muthukrishna

031260 2494

muthukri@ukzn.ac.za

2.3.1 Incwadi eya kuMzali/uMnakekeli

**School of Education and Development
Faculty of Education
University of KwaZulu-Natal
Edgewood Campus
Private Bag X03
Ashwood
3605
1 July 2009**

Igama loMzali
Ikheli

Mnumzane/Nkosikazi

Isicelo semvume yakho sokuqhuba ucwaningo nengane yakho: Igama leNgane Ngiqhuba ucwaningo ebangeni eliphezulu lemfundo eNyuvesi yakwaZulu-Natal. Njengoba ngangichazile emhlanganweni esasinawo, Ngifisa ukuqhuba ucwaningo 'eKwahlukaneni kwabafana namantombazane ekuphumeleleni iZibalo'. Eminyakeni edlulile ngathinteka ngezinga eliphansi abafundi abaphumelela ngalo ezibalweni lapho ingane yakho ifunda khona, ikakhulukazi abafana uma beqhathaniswa namantombazane. Ngifisa ukubhekisisa ngijule imbangela yalokhu. Ngicela imvume yakho ukuthi ngiqhube ucwaningo lwami nomntwana wakho. Lolucwaningo lumayelana nokufunda kuphela.

Ulwazi olutholakele luzophathwa ngokucophelela. Angeke adalulwe amagama abafundi, othisha kanye negama lesikole kulolucwaningo lwami.

Imininingwane yami kanye neyomlolongi wami inkeziwe uma ufuna ukucaciseleka kabanzi ngalolucwaningo.

IFOMU LEMVUME

Ngiyasiqondisisa isimo salolucwaningo. Ngियाqonda ukuthi ingane yami ikhululekile ukuthi ingashiya noma kunini kulolucwaningo. Ngियाqonda futhi ukuthi kunesiqiniseko sokugcinwa kolwazi olunikeziwe lufihlekile. Ngakhoke ngiyavuma ukuba umntwana wami abambisane nawe kulolucwaningo.

Igama _____ Usuku _____
Sayina _____

Yimina ozithobayo

Ms Carol Bongi Khwela

0319068618

981174349@ukzn.ac.za

Professor Nithi Muthukrishna

0312602494

muthukri@ukzn.ac.za

2.4. Letter to Learner

School of Education and Development
Faculty of Education
University of KwaZulu-Natal
Edgewood Campus
Private Bag X03
Ashwood
3605
1 July 2009

Dear _____

Re: Request for consent for your participation in my research

I am presently studying for Masters in Education at the University of KwaZulu-Natal. As I explained to you at our initial meeting, I am keen to begin my research on the 'Gender differences and academic achievement in Mathematics'. Over the years, I have become concerned about the low academic achievement in Mathematics of learners at your school, especially the under-achievement of boys as compared to girls. I would like to investigate this issue in greater depth. I hereby request your consent to participate in my study. The research is for academic purposes only.

All information will be treated with confidentiality. At no stage will your name, the name of your school or teachers be mentioned in my study.

My contact details and those of my supervisor are provided in the case you might need further clarification on the study.

CONSENT FORM

I understand the nature of the study. I understand that I will have freedom of withdrawal from the study at any time. I also understand that anonymity and confidentiality will be assured. I therefore agree to participate in the study.

Name of learner:

Date

Sign:

Yours faithfully

Ms Carol Bongi Khwela

031 9068618

981174349@ukzn.ac.za

Professor Nithi Muthukrishna

031 260 2494

muthukri@ukzn.ac.za

2.4.1 Incwadi eya kuMfundi

School of Education and Development

Faculty of Education

University of KwaZulu-Natal

Edgewood Campus

Private Bag X03

Ashwood

3605

1 July 2009

Mfundi _____

Isicelo semvume yakho ukuba sibambisane ocwaningweni lwami

Ngiqhuba ucwaningo ebangeni eliphezulu lemfundo eNyuvesi yaKwaZulu-Natal.

Njengoba ngangichazile emhlanganweni esasinawo, nginesifiso sokuqala ucwaningo 'eKwahlukaneni kwabafana namantombazane ekuphumeleleni iZibalo'. Eminyakeni edlulile ngathinteka ngezinga eliphansi abafundi abaphumelela ngalo ezibalweni lapho ufunda khona ikakhulukazi abafana uma beqhathaniswa namantombazane. Ngifisa ukubhekisisa kabanzi imbangela yalikhulu. Ngicela uvume ukuba sibambisane ocwaningweni lwami. Lolucwaningo lumayelana nokufunda kuphela.

Ulwazi olutholakele luzophathwa ngokucophelela. Ngeke igama lakho elesikole, kanye nothisha kudalulwe kulolucwaningo lwami.

Imininingwane yami kanye neyomlolongi wami inikeziwe uma ufuna ukucaciseleka
kabanzi ngalolucwaningo

IFOMU LEMVUME

Ngiyasiqondisisa isimo salolucwaningo. Nginyaqonda futhi ukuthi ngikhululekile ukushiya
noma kunini kulolucwaningo. Nginyaqonda ukuthi kunesiqiniseko sokugcinwa kolwazi
olunikeziwe lufihlekile. Ngakhoke ngiyavuma ukubambisana nawe kulolucwaningo.

Igama lomfundi:

usuku

Sayina

Yimina ozithobayo

Ms Carol Bongi Khwela

0319068618

981174349@ukzn.ac.za

Professor Nithi Muthukrishna

0312602494

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Appendix 3: Ethical Clearance from University of KwaZulu-Natal, Research Office



**UNIVERSITY OF
KWAZULU-NATAL**

*University of KwaZulu-Natal
Research Office
Govan Mbeki Centre
Westville Campus
University Road
Chiltern Hills
Westville
3629
South Africa
Tel No: +27 31 260 3587
Fax No: +27 31 260 2384
E-mail : naidoo4@ukzn.ac.za*

28 October 2009

Ms C B T Khwela
E1259 Umlazi
Umlazi Township
4031

Dear Ms Khwela

PROTOCOL: Gender differences and academic achievement in mathematics: A case study of learners in a primary school in KwaZulu-Natal

ETHICAL APPROVAL NUMBER: HSS/0740/2009: Faculty of Education

In response to your application dated 15 October 2009, Student Number: **981174349** the Humanities & Social Sciences Ethics Committee has considered the abovementioned application and the protocol has been given **FULL APPROVAL**.

PLEASE NOTE: Research data should be securely stored in the school/department for a period of 5 years.

take this opportunity of wishing you everything of the best with your study.

Yours faithfully

Professor Steve Collings (Chair)

HUMANITIES & SOCIAL SCIENCES ETHICS COMMITTEE

C/sn

:: N Muthukrishna

:: Ms R Govender

