



**GENDER GAPS IN ACHIEVEMENT WITH REGARD TO MATHEMATICS IN GRADE 12
WITH SPECIAL REFERENCE TO MUTSHINDUDI CIRCUIT, LIMPOPO-SOUTH
AFRICA**

BY

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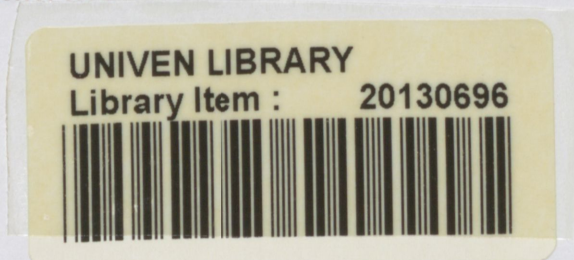
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**A DISSERTATION FOR THE PARTIAL FULLFILLMENT OF MASTERS DEGREE IN
GENDER STUDIES.**

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DECLARATION OF AUTHENTICITY

I, the undersigned, *Tendani Grace Mauda*, declare that this dissertation is my original work, gathered and utilized especially to fulfil the purposes and objectives of this study [Masters in gender studies at the University of Venda] and has not been submitted to any other university. I also declare that the publications cited in this work have been personally consulted.

Signature *TG Mauda*

Date 15-01-2013

I dedicate this dissertation to my family, especially:

To my children, Rendani, Aluwani, Rofhiwa and Rinae, for opening my eyes to the world.

To my husband, for his patience and understanding .

To my mom Matodzi and my sister Lusani ,for their support and encouragement.

To Dr, Mphaya Nemudzivhadi, for instilling the importance of hard work and higher education.

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ABSTRACT

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ABSTRACT

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The goal of this research is to investigate and address gender-based differences in the learning of Mathematics, the diffusion of research-based innovations, and extension services in education that will lead to a larger and more diverse learning of Mathematics by both genders. The research seeks to advance efforts of participation by women and girls in the field of Mathematics where they continue to be underrepresented. In the context of this overarching goal, the research seeks to support activities that address the academic achievement in Mathematics by female students in Grade 12 at Mutshindudi circuit in the Vhembe district of Limpopo province, South Africa. The findings of the research are that parental involvement in the academic lives of girls play a pivotal role in their overall success in life.

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CHAPTER 1

Examining Mathematics results in South Africa together with the countries who take African languages, and presumably the bulk of those would be African, the difference between male and female attainment in the subject was enormous.

1. INTRODUCTION

was exhibiting the greatest difference. In other words there was a massive difference in the number of African girls and boys joining.

1.1 Background

Historically, mastery of Mathematics was viewed as not possible for all racial groups and hence reserved for white, middle-class males. However, over the past three decades, there have been stringent efforts in many different countries to redress this perception. Intervention programmes aimed at improving female participation rates and attaining equity in levels of achievement in mathematics have been initiated and, to some extent these efforts have succeeded (Leder, Forgasz & Solar, 1996).

this provision, students' attitudes and beliefs attribute to difference in subject consideration. There is considerable anecdotal and research. For some time, scientists have observed that boys score much higher than girls on mathematics tests. Based on studies of more than 100 000 intellectually gifted 12 and 13 year olds, for example, there are 13 boys for every girl who scores at least 700 out of 800 on the Mathematics section of the Scholastic Aptitude Test (SAT).

attitudes in their attitudes, expectations for life, interest in challenging courses and learning careers, and pursuit in maths and science decline as. In the former Soviet Union and Eastern Europe after World War 2, acute shortage of skilled labor facilitated many women's entry into non-traditional studies and careers. Now the percentages of women in traditional 'male' disciplines (engineering, economics, medicine, mathematics and natural sciences) are high. For example, in Poland 60 per cent of mathematics and science as they grow older. Usually girls have more positive attitudes toward

natural science students were women in 1991 and 1992 and 46 per cent in the Former Democratic Republic of Russia, in 1987.

Examining Mathematics results in South Africa together with the numbers who take African languages, and presumably the bulk of these would be African, the difference between male and female attainment in this subject was enormous with the poorer provinces exhibiting the greatest difference. In other words there was a massive difference in the number of African girls and boys pursuing Mathematics (*Issues on Gender in School: an Introduction for teachers; 2002:31*).

The Constitution of the Republic of South Africa(Act 108 of 1996) states that “The state may not unfairly discriminate directly or indirectly against anyone on one or more grounds, including race, gender, sex, pregnancy, marital status, ethnic or social origin, colour , sexual orientation, age, disability, religion, conscience, belief, culture and language.” Equality is stressed whether you are male or female. Despite this provision, students’ attitudes and beliefs attribute to difference in subject consideration. There is considerable anecdotal and research evidence that girls and women generally express less confidence about their mathematical abilities than boys and men. (Dwek, 1996; Willis, 2000).

An American Association of University Women’s article shows that girls’ self-esteem, confidence in their abilities, expectations for life, interest in challenging courses and rewarding careers, and pursuits in maths and science decline as they get older. Gill & Judith (2001) indicate that middle school and high school girls have positive attitude towards school but negative attitude towards mathematics.

Swetan & Daniel (2000) shows that girls’ positive attitude toward mathematics decline as they grow older. Initially girls have more positive attitudes toward

mathematics than boys do, but as they continue, it becomes more negative. Sometimes teachers' attitudes contribute to learner's difference of attitude toward a subject. Clewell, et al (2004) highlights the barriers middle school girls of color face in Mathematics classes. These barriers include teachers, parents, and society's expectations impact on girls' attitudes and perceptions, achievement and performance, course enrolment and participation, career interest and aspirations Gutbezahl and Jennifer (2003). Girls tend more to internalise their teachers and parents' negative expectations, which become self-fulfilling prophecies. Schwarts, et al (2006) suggest that teachers must consider girls' developmental issues as they interact with them, by drawing female students' attention away from their bodies and focusing it on their intellectual abilities, especially in Mathematics.

1.2 Statement of the research problem

There is a gender bias when it comes to the learning of Mathematics at schools and high institutions of learning, and that this bias is fuelled by the belief that female students achieve less than their male counterparts in Mathematics.

1.3 Aims and objectives

The goal of this research is to investigate and address gender-based differences in the learning and mastery of Mathematics, the diffusion of research-based innovations into the schools and extension services in education that will lead to a more diverse learning strategies in Mathematics for both genders. Ultimately the research seeks to advance efforts in participation by women and girls in the field of Mathematics where they continue to be underrepresented. In the context of that overarching goal, the research seeks to address the following objectives:

- 1.3.1 To determine how the academic achievement in Mathematics by female students in Grade 12 at Mutshindudi circuit differs (if at all) from those of male students.
- 1.3.2 To determine how the different groups of students in Grade 12 at Mutshindudi circuit (males and females) view the teaching and learning of the subject Mathematics.
- 1.3.3 To discover and describe gender-based differences and preferences in learning Mathematics and factors that affect interest, performance and choice of the subject.
- 1.3.4 To describe how experiences and interactions in informal and formal educational settings based on gender inhibit or encourage interest and performance of students in Grade 12 at Mutshindudi circuit.
- 1.3.5 To increase understanding, insight and clarity of the gap to try and effect change in as far as the learning of Mathematics is concerned.

1.4 Research Questions

- 1.4.1 How does the academic achievement in Mathematics by female students in Grade 12 at Mutshindudi circuit differ from those of male students?
- 1.4.2 How do different groups of students in Grade 12 at Mutshindudi circuit (males and females) view the teaching and learning of the subject Mathematics?
- 1.4.3 What are the genders based differences and preferences in learning Mathematics that affect interest, performance and choice of subjects?
- 1.4.4 How do experiences and interactions in informal and formal

educational settings inhibit or encourage interest and performance of students in Grade 12

1.4.5 How can the understanding, insight and clarity of the gap be increased in order to effect changes in as far as the learning of Mathematics is concerned?

1.5 Significance of the study.

South Africa was crippled by racial and gender injustice for over fifty years. These injustices have filtered through to the education system. While great strides have been taken to bridge the race gap, addressing gender inequality in education has for the most part been put on the backburner. With greater emphasis on Mathematics and Science and 4 out of every 5 people being women, it is clear that women in Mathematics and Science hold the key to a successful global economy, and the South African economic growth in particular.

South Africa is somewhat behind the ball with regards to gender equality in education. This inequality needs to be addressed soon or we risk falling into third world status because of the sheer lack of human capital. To rectify any problem, the root of the problem must be identified first, that is why a study like this is of utmost importance. This study will help identify what causes the gender gap in Mathematics scores, then we can move to the next step which is addressing the causes.

There have been a lot of myths in the past stating that boys are naturally better at Mathematics than girls. This study aims to give an objective view on this matter and then hopefully assure girls that under the same conditions, they can do as well as boys in Mathematics. The results of this study will therefore, hopefully remove the stigma attached to girls wanting to do well in Mathematics.

attainment, wage rates of labour force participation
(www.dwarf.gov.co.za)

b. A broad difference between men and women, as in *There is still an*

1.6 Definitions of terms

1.6.1 Gender

a. A state of being male or female, typically with reference to social or cultural differences rather than biological differences (www.umw.edu/bias/terms).

a. Something accomplished successfully, especially by means of

b. Gender refers to the different and interrelated roles and responsibilities of women and men. These are culturally specific, socially constructed, and can change from generation to generation, from place to place and from time to time (www.ldrc.org/fr/eu-126).

a. Something achieved or won by exertion; some plan or action carried

c. It is also a term to describe the socially constructed differences between men and women, referring not only to individual identity and personality, but also, at the symbolic level, to cultural ideas and stereotypes of masculinity and femininity and, at the structural level, to the sexual division of labour in institutions. (www.arroweduction.org/Glossary.htm)

1.6.2 Mathematics

1.6.2 Gap

An empty part, space or blank space. [*The world book dictionary 1987:878*]

ematics is a body of knowledge centered on such concepts as quantity, structure, space and change, and also the academic

1.6.3 Gender gap

a. Gender gap is any statistical gap between the measured characteristics of men and women in areas such as educational

attainment, wage rates of labour force participation

(www.dwarf.gov.co.za)

- b. A broad difference between men and women, as in *There is still an enormous gender gap in the wages of unskilled labor*. This expression at first referred to the difference between men and women in voting preferences. It has been since extended to other areas. [1970s] (C Ammer, 1992, *Dictionary of Idioms*)

1.6.4 Achievement

- a. Something accomplished successfully, especially by means of exertion, skill, practice or perseverance (Houghton Mifflin Company, 2006 :*Dictionary of the English language, fourth edition*).
- b. Something accomplished, especially by superior ability, special effort, great courage (Random House, inc. 2009).
- c. Something achieved or won by exertion; some plan or action carried out with courage or unusual ability [*The world book dictionary, 1987:16*]
- d. In the context of this research achievement means the attainment of good results in as far as Mathematics as a subject is concerned.

1.6.5 Mathematics

- a. Mathematics is something absolute, exact or accurate [*The world book dictionary 1987: 1282*].
- b. Mathematics is a body of knowledge centered on such concepts as quantity, structure, space and change, and also the academic discipline that studies them. Benjamin Peirce called it “the science that draws necessary conclusions” (en.wikipedia.org/wiki/Mathematics).

CHAPTER TWO

2. LITERATURE REVIEW

2.1 Introduction

One hundred years ago, people believed it was not “healthy” for women to receive an education. Specifically, “doctors warned that education redirected blood, initially destined for the ovaries, to the brain. The result: Educated women would be less likely to reproduce and more likely to go insane” (Sadker: 1999, 82). Although obviously a ridiculous statement today, that particular belief kept many women far from education many years ago. Now women have shown interest in receiving an education (Longfield & Nowak, 2001). “ Until 1980, Ivy League schools such as Columbia University did not even admit women whereas today the majority of college students are women” (Sadker,1999:22).

Now, more than even before, the door is wide open for women to seek and obtain careers that their mothers would have never thought possible. Although the door is wide open for women, one specific area we need to examine more closely if we truly want to establish complete academic gender equality is Mathematics.

Since the early 1970s, there has been a concern about gender differences in mathematics achievement and participation in advanced mathematics courses in high schools and colleges, as well as the under-representation of women in mathematics-related careers like engineering and physics (Hyde. et al, 1990). When the mathematical achievement differences of elementary age boys and girls are examined, researchers find few differences in achievement. However, gender differences in Math scores on standardized tests begin to appear in the middle schools and widen into a gender gap when enrolment in advanced science and Math elective courses in high school are analyzed (Campbell & Beaudry, 1991). Gender gap in this research refers to statistical difference between the measured characteristics of men and women in Mathematical attainment and participation.

2.2 An overview on issues of gender

It is worthwhile to unpack issues of gender and intellectual capabilities between women and men around the world in order for us to be able to debunk myths formulated by patriarchy. R.W.Connel (2001) notes that gender is a topic on which there is an amount of prejudice, ideology, myth, misinformation and outright falsehood (Connel,2001,p.viii).

Girls have been classified as lacking in scientific knowledge systems and as a result, relegated to only subjects that have been “feminized” in institutions of learning. These myths are borne out of the belief that being a man or a woman is a fixed state. Gender is a condition under construction. Prolonging this argument, a French Feminist, Simone De Beauvoir, said that ‘One is not born masculine, but acquires and enacts masculinity, and so becomes a man (Beauvoir as cited by Connel, 2003, p.4). This means that we cannot think of womanhood or manhood as fixed or positioned by nature.

Psychological research has also proven that many of us combine masculine and feminine characteristics. Invariably, we cannot argue that girls are less gifted as a monolithic group.

A study made by Barrie Thorne (1993) unraveled interesting observations when researching behavioral patterns of boys and girls at a high school in the US. His findings were that boys and girls could all play together in any game offered to them. He observed that boys normally control more of the playground than girls, and that boys usually make aggressive moves in the quest to cling on to some power. They go on to call “low status” boys “girls”. This name calling suggests male superiority and a social construct that denotes that girls are inferior. He also notes that rural men do not deny that men had control. The study also found that women performed masculine functions especially in their homes and/or in the farms. Gender arrangements were therefore brought into existence by circumstances which are historical. Masculinity has to do with toughness, physical dominance and aggressiveness, traits which can also be found in women as well. Due to the migratory labour system, we witness an exodus of men moving into the mines while women remained home to eke out a living on behalf of their families. This means that they were heads of their families when men were not around.

In the former Soviet Union, the Communist government put a prominent Feminist into power (Minister for Social Welfare) who made immense investment in girls and women’s education. Women also participated in technical employment and industry, thus debunking the myth that these terrains were are only for men (see Connel2008). However, it is also noted that when the Soviet Union crumbled, the status

–quo in the former Soviet States reverted to being dominated by men who started to craft their nation building with an aggressive masculinity (Cornell,2008,p.24).

This analogy is somewhat confusing when looking at the fact that the Soviet Union was moving away from patriarchy in 1917. Svetlana Alescievich in her book entitled 'Zinc Boys', also alludes to the fact that women participated in wars, were also brutalized, lost limbs and life. However their experiences were not captured. It is documented that most of them were also brutalized by their male counterparts.

At the core of this differential treatment between men and women, as well as boys and girls is the belief that women (girls) are inferior to men both intellectually and emotionally. The belief that boys fight and steal because of testosterone is also fraught with unscientific assertions. Cornell further argues that in the early stages of development, male and female bodies are relatively undifferentiated. (Cornell,2008) says that there are small differences between a two year old girl and a two year old boy. This is also apparent in their reproductive organs. These organs develop embryonically from a common starting point. Even in old age, their bodies become similar (Cornell,2008, p.29). Neuroscientists also argue that the brain does not choose to be either a female or male type (see Roggers, 2000). Therefore, it cannot be scientifically proven that men are stronger and faster than women, and that women are only good at idle work or that men have stronger sexual desires than women.

From the above reasoning, we can deduce that our human bodies are affected by social processes. It is mainly men who advance their gender differences to defend their patriarchal beliefs or gender order. Socio biological ideas about gender differences cannot be presented as scientific truth when analyzing gender differences. We also know that scientific perceptions of bodily differences change

over time. This is an evolutionary process. In a nutshell, sex is a biological fact (that is there is a sexual difference between male and female species) whereas gender is a social fact, defined by Connell (P.33) as the difference between masculine and feminine roles, or men's and women's personalities. Biology should therefore not be used to justify women's subordination.

When researching verbal ability between men and women, Kristen Kling (1999), Hyde and McKinley (as cited by Connell, 2008) argue that gender differences with regard to general verbal ability appear to be minimal among the different sexes. In fact, some men appear to be more verbal than women, and some women appear to have more mathematical abilities than men. It is based on the above that we turn to factors that perpetuate the gender gap between men and women. From the researcher's observation, personal experience and literature review, gender gap in Mathematical achievement is brought about by the following factors:

2.3 Myths about Mathematics and gender.

In most instances, women who do not perform well in some subjects these days believe that their ability level is fixed, and that is why they fail mathematics or to solve abstract questions. Benajji et al, in their study dated 2002 found that the stereotypes regarding women in Math and Science are well entrenched, and are also accepted by the society, and in particular by teachers and parents. One other myth exposed by Campbell and Soro (1996) is that women are more qualitative whereas men are more quantitative. This belief psychologically prepares women to accept the idea that they are less apt to go into Math-related careers. The two researchers also uncovered a myth that there was/is a Math gene that is linked to the sex of a person. It was widely researched that positive attitudes about Mathematics can in fact increase the tendency of students to

select Mathematics courses. Dwek (1996) and Wills (2000) have also shown that women can also be enthused to appreciate Mathematics in order not to have less confidence about their Mathematical capabilities. Bowman (2003) has also discovered that there are different perceptions between boys and girls regarding performance in Mathematics. Girls have been recorded to have negative attitudes towards Mathematics especially when they grow older. This negative attitude is attributed by them not seeing any usefulness of the subject towards the empowerment of women. However, it is also reported that girls have more positive attitudes towards the subject at middle school and high schools. They tend to feel less confident in the classroom because of the stereotypes ideas that have been put in place by our cultural belief systems. Bevan (2001) notes that this disparity might be perpetuated by our curriculum and pedagogy of schools which is more patriarchal and andocentric.

2.4 Pedagogical problems

In institutions of learning, most, if not all students aspire to be like their teachers. Unfortunately, most teachers, as studies have shown, have different beliefs about male and female students. They too have stereotyped Mathematics as a male domain, and further hold positive attitudes about male students. This has a negative tendency of demoralizing female students. Leach (1994) succinctly showed a teacher's critical role in girls' success in Mathematics. Li (1999) also found that teachers have different beliefs about male and female students. Meyers and Koehler (1991) found that girls perceive their teachers and peers as having lower expectations for their success in Math.

Campbell (1996), Clewel and Anderson(1991) and Shwartz and Hanson(1999) all indicate that teachers should change their viewpoint regarding girls and should also praise them so that they can enter into the science field without

inhibitions, and be on an equal footing with boys. Campbell (1996) believes that teachers are failing to lessen the gender gap in the classroom and are also a cause of differential gender treatment that exists between boys and girls. Li (1999) established that teachers are still reinforcing negative traditional beliefs about girls in spite of the fact that many girls (females) have proven to be more gifted, if not than, boys.

The style of teaching by teachers has also proven to be detrimental to the needs of girls. It has been proven that girls learn better in a cooperative atmosphere, as opposed to boys who are more competitive in nature (see Diamond, 1994). This means that classes which are more receptive and non-competitive have to be designed for female learners who are enthusiastic about Mathematics. Female students have to be allocated more time to learn so as to accommodate their learning patterns. Research has also proven that girls participate more if Maths as a subject is linked to their day to day, or life experiences (McSheffrey; 1992, Berry; 1993 and Jackquiline et al, 1993).

Also worth noting is the fact that there should be some alternative ways of assessing females' learning in Math classes. Traditional ways and societal attitudes about class, race and gender have affected our ways of learning. Audrey (1989) mentions that these ways of measuring success have had a **negative impact on girls' way of learning.**

On the whole, teachers should be able to arouse feelings of competence in Math for females. McSheffrey further suggests that teachers should incorporate reading, music and Math in one lesson so that learning Mathematics can be fun. The learning abilities of girls have been shown to be more cooperative than competitive, as shown with boys. Girls need to have more Mathematics- related experiences brought into the classroom, as alluded to earlier. This means that there should be a curriculum that emphasizes this approach. This will in turn enhance girls enthusiasm in learning Mathematics. One other aspect worth

noting is that teachers should use alternative assessment techniques and non-traditional activities as a way of improving girls' participation in Math classes (see James, 1993 and Audrey 1989). Audrey (1989) also observed that societal attitudes about race, class and gender affect girls immensely.

2.5 Gender and Mathematics: Views from the First and Third World Countries

The United States of America has been at the forefront of studying gender gaps in Mathematics, especially in the area of education and psychology as far back as 1970. These studies have shown that the Math gap between males and females does not appear until adolescence. This difference actually appears at the age of twelve and thirteen, especially in secondary schools.

Some psychologists (see Stanley and Benbow, 1996) argue that the differences between male and female education are biological and genetically determined. This assertion was later attacked for not having any scientific proof. Fenma and Sherman (1977, 1978) showed that gender differences in Math classes will disappear only if females participated in advanced Mathematics classes at the same rate with their male counterparts.

Research has also shown (especially in the US) that women, like men, also excel in Math when they are given the resources to prove themselves, and also a conducive environment to study Mathematics. However, there are those who ascribe satisfactory performance in Math and science to genetics (see Gray, 1981) by arguing that the physical development of boys' brains is more powerful than girls (see Child & Smithers, 1971). They argue that women have a genetic deficit, and lack the basic intellectual equipment to profit from science education.

In England, however, the gender gap in Math performance is narrowing. This has been aided by feminist movements that have been advocating for change. But girls in the U.K. still lag behind when choosing Mathematics at a higher level of education.

2.6 Gender disparities in Africa

The history of patriarchy and colonization has played a major role in the gender disparities that exist to date. The former colonizers made a direct transfer of their curricular to the African setting without taking into consideration, the cultural milieu of the Africans themselves. This also included the transfer of examinations and teaching materials and methods. This has resulted in the knowledge of most subjects being transmitted by ill-prepared teachers in overcrowded and under-resourced classrooms

Griffiths (2005) opine that this scenario is exacerbated by the teachers' poor training and incompetency in the levels of assessment. In Nigeria, for instance, academic performance in Mathematics is so depressingly low. In this regard, an educator, Kutetu, had this to say:

“Unfortunately, while a lot of gender programmes have been carried out, not much research has been done within the classroom in the continent. Our understanding of gender in the classroom practices is most often based on what has been studied in Western Europe and North America. I would argue that there is always a cultural angle in studies of social practices.”

Kitetu's remarks resonate well with the cultural aspects of the African Continent. It is without a doubt that patriarchy, which still relegates women (or girls) to a

lower status, also affects girls negatively when it comes to education, especially in the area of Mathematics. However, it is heartening to note that there are some positive trends appearing as a result of the work done by Non-Governmental Organizations in Africa, in as far as gender mainstreaming and the access for females in Mathematics education is concerned. The promotion of gender equity and the empowerment of women as a way of eliminating inequality in primary and secondary education by the UN are also remarkable. (For more information, please read the millennium declaration signed by the United Nations in 2000).

2.7 Summary

This chapter elucidates different perceptions about the performance of girls in as far as Mathematics is concerned. It also lays the foundation for understanding some of the myths surrounding gender and the intellectual acumen possessed by both girls and boys.

CHAPTER THREE

3 RESEARCH DESIGN AND METHODOLOGY

3.1 Introduction

The intention of this chapter is to detail the research design and methodology, which made it possible for the researcher to ascertain gender gap in achievement of Grade 12 learners as far as the subject Mathematics, is concerned. This chapter describes the research approach used, gives an overview of the research design, outlines the data collection and analysis methods and discusses the constraints and limitations of the research. Ethics in this research is also discussed and the literature that was reported in chapter two provides a theoretical framework for the research.

Taylor (2000) says research is an integral part of society. It is a means of exploring one's own environment to educate oneself and to explain some facts or events. Mc Millan & Schumacher (1993) emphasized that research provides a better source for knowledge and decision making than personal experience, belief, tradition, logic, or intuition alone. The research purpose influences the type of information that is sought from a study. This research used both quantitative and qualitative research design. The division between qualitative research and quantitative research occurs at the level of methods, not at the stage of epistemology or theoretical perspective, where distinctions between objectivist research, and positivist research, and constructionist or subjectivist are manifested (Crotty, 1998). Although these methods are perceived to be distinct, there is an increasing move to demonstrate that qualitative and quantitative

research do not necessarily fit in separate research paradigms, hence they can be judiciously used within the same research (Scott, 1996).

3.1.3 Qualitative Research

In the most elementary sense, the design is a logical sequence that connects empirical data to a study's initial research questions and ultimately, to its conclusions. In a sense the research design is a blue print of research, dealing with at least four problems: What questions to study, what data are relevant, what data to collect, and how to analyze the results (Yin, 1994). It is much more than a work plan because the main purpose is to help to avoid the situation in which the evidence does not address the initial research questions. Hence the research design deals with a logical problem and not a logistical problem, and also specifies how the investigator will address the two critical issues of representation and legitimization. Furthermore, a research design describes a flexible set of guidelines that connects theoretical paradigms to strategies of inquiry and methods for collecting empirical material. It situates researchers in the empirical world and connects them to specific sites, persons, groups, institutions, and bodies of relevant interpretive material, including documents and archives.

- The primary aim is in-depth ('thick') descriptions and understanding of actions and events.
- The main concern is to understand social action in terms of its specific context (idiographic motive) rather than attempting to generalize to some theoretical postulation.
- The research process is often inductive in its approach, resulting in the generation of new hypotheses and theories.
- The qualitative researcher is seen as the 'main instrument' in the research process.

The research process was characterized by the following factors:

3.2 Research Approach

3.2.1 Qualitative Research

Qualitative research is best defined as a multi-method in focus, involving an interpretive, naturalistic approach to its subject matter (Denzin & Lincoln, 1989). Huberman & Miles (2002) state that, the core requisites for qualitative analysis seem to be a little creativity, systematic doggedness, some good conceptual sensibilities and cognitive flexibility. Cognitive flexibility in the sense of having the capacity to rapidly undo one's way of construing or transforming the data to try another, more promising tack. Miller and Salkind (2002) add grounded theory, narrative research and ethnography as important traditions of qualitative inquiry. Babbie and Mouton (2001, 270) indicate that qualitative research is differentiated from quantitative according to these core characteristics:

- Research is conducted in a natural setting of social actors.
- A focus on process rather than outcome.
- The actor's perspective (the 'insider' or 'emic' view) is emphasized.
- The primary aim is in-depth ('thick') descriptions and understanding of actions and events.
- The main concern is to understand social action in terms of its specific context (idiographic motive) rather than attempting to generalize to some theoretical postulation.
- The research process is often inductive in its approach, resulting in the generation of new hypotheses and theories.
- The qualitative researcher is seen as the 'main instrument' in the research process.

The research process was characterized by the following factors:

- *Natural setting*: The research was conducted in the school premises, in classrooms.
- *Focus on process*: Events as they occurred were studied; hence Mathematics as experienced by learners and educators was the focus.
- *Actor's perspective*: An attempt was made to view Mathematics as experienced from the participants' viewpoints to try and understand their actions and decisions from their own positions.
- *In-depth descriptions and understanding*: The actions of participants in research were described in detail, with attempts to understand the actions in terms of the participant' own beliefs, historicity and contextuality.
- *Ideographic motive*: An attempt was made to understand events, actions and processes in their context. Hence, the broad context was taken into account.
- *Qualitative researcher as main instrument and objectivity*: As the main instrument in the study, the researcher was required to be unbiased as far as descriptions and interpretation are concerned.

Qualitative methods were used in this study to enhance the quantitative research because they are useful for ascertaining issues that are readily quantifiable such as interviews. In this research, standardized open-ended interviews were used. In the standardized open-ended interviews, participants are asked the same questions in the same order, thus reducing interviewer effects and bias, however, standardized wording of questions may constrain and limit naturalness and relevancy of the response (Mc Millan & Schumacher 1993).

A proliferation of literature debating the strengths and weaknesses of qualitative research exists (Babbie and Mouton, 2001; Miller and Salkind, 2002; Burton,

2000). The strengths and weaknesses of qualitative research pertinent to this study are mentioned below.

Qualitative research provides an understanding and description of the participants' personal experiences of phenomena-the emic or insider's viewpoint. The participants' viewpoint is especially important in this research because learners' personal experience in mathematical classroom will be taken into account. The data tell us a story, which is useful for in-depth analysis. The data can give detailed description of phenomena that are situated and embedded in local contexts such as the classroom and the school.

Weaknesses include the collection of vast body of data, which makes data capture, categorization and analysis time consuming and difficult. Vital observations can readily get lost in the mass of information, which is awkward to categorize and delineate into manageable sections. Furthermore the results are easily influenced by the researchers' personal biases and agendas. The knowledge produced may be unique to the participants in the research, as it is difficult to make predictions based solely on qualitative data.

While qualitative research relies on observation and written description, quantitative research uses statistical methods to show relationships between variables (McEwan and McEwan, 2003). To counter the weakness of qualitative research and to ensure the measurement of findings, quantitative research was core to the study.

3.2.2 Quantitative Research

Quantitative studies emphasize the measurement and analysis of casual relationships between variables, not processes. Inquiry is purported to be within a value-free framework (Denzin and Lincoln, 1998-8).

In contrast to the qualitative research described previously, quantitative research is best defined as the measurement of the properties of phenomena, which is the assignment of numbers to the perceived qualities of phenomena (Babbie and Mouton, 2001).

The division between qualitative research and quantitative research occurs on the level of methods, not on the stage of epistemology or theoretical perspective, where distinctions between objectivist and positivist research, and constructionist or subjectivist research are manifested (Crotty, 1998) Although these methods are perceived to be distinct, there is an increasing move to demonstrate that qualitative and quantitative research do not necessarily fit in separate research paradigms, hence, they can be judiciously used within the same research (Scott, 1996). The strengths of quantitative research lie in its perceived status as being more reliable and having greater validity than qualitative research (Hammersley, 2002). This fact ensures that quantitative research is prioritized by many researchers in different countries, if researchers are to make an impact on policymaking and practice then their research needs to be taken seriously. Quantitative research is useful in the conceptualization, measurement and analysis of findings (Denzin and Lincoln, 1998). In this study learners' responses to questionnaires were counted and basic statistical measures used. This quantitative approach does lend a measure of reliability and validity to the research. Quantifiable data can be measured numerically, meaning that it is more precise (Gray, 2004). However this needs to be juxtaposed with its inherent weakness which is the possibility of losing a great deal of information. What can

be discounted is the account behind the account, as quantitative measures do not allow the whole picture to emerge.

The bulk of the study consisted of quantitative research in the format of questionnaires, using learners as respondents, to ascertain information about the gender gap in performance in mathematics.

3.3 Overview of research design

In this section, an overview of the methodology, including a summation of the research phases and processes, a synopsis of the sample, and an explication of the procedure are provided.

3.3.1 Outline of methodology

By methods, we mean the range of approaches used in educational research to gather data which are used as basis for inference and interpretation, for explanation and prediction (Cohen and Manion, 1985;42).

Methodology refers to the strategies, plans of action, processes or designs foundational to the choice and implementation of specific methods, as well as the linking of the selection and implementation to the desired outcomes (Crotty, 1998).

3.4 Sampling Procedures

In this study, convenience sampling (also called *available sampling*) was used. In convenience sampling a group of subjects is selected on the basis of being accessible or expedient. In this study, five schools at Mutshindudi circuit under

Vhembe district were selected because of their accessibility. In these five schools, learners who do mathematics in Grade 12 were selected as participants. Grade 12 mathematics teachers from these schools were also selected as participants. Learners were given a questionnaire to respond to, while teachers responded to an unstructured interview. In order to adhere to ethical principles of a research names of schools and participants were changed. This study named the selected schools, school A, B, C, D and E. School A have 47 learners, school B have 20, school C have 32, school D have 25 and school E have 37, which makes a total of 161 learners. A total of 10 teachers from these selected schools were interviewed.

3.5 Profiles of participants

3.5.1 TENDANI

Tendani is a 36 year old teacher who has been teaching at A secondary school for the past fourteen years. She is teaching Mathematics in Grade 12 which has about 20 female students and 27 male students. She is a qualified teacher who has a diploma in education. She is an experienced teacher who has taught in several secondary schools including urban area before she was appointed at the rural A secondary school.

3.5.2 TSHIPO

Tshipo is 34 year old teacher who has also been teaching at A secondary school for the past 3 years. She is teaching mathematics grade 12 together with Tendani. Tshipo is a Zimbabwean national with a lot of experience as a teacher

in Zimbabwe. She is highly qualified with a degree and an honours in Mathematics.

3.5.3 AZWINNDINI

Azwinndini is a 24 year old teacher at B Secondary school. This is his second year at the school, where he was appointed straight out of university. He is one of three Grade 12 Mathematics teachers at B secondary school. Azwinndini studied Applied Mathematics and Physics at university, and is currently enrolled for a teaching diploma. Together with Matamela (see below), they have managed to increase the number of students registering for Mathematics, both male and female.

3.5.4 MATAMELA

Matamela is a 40 year old Mathematics teacher at B Secondary. He has been with the school for the past sixteen years and teaches Grade 12 Mathematics. Matamela is a qualified teacher who has a lot of experience. He has taught in several schools in the district.

3.5.5 GUNDO

Gundo is a 32 year old teacher at C Secondary school. She has been with the school for the past 3 years and is one of two Grade 12 Mathematics teachers. She gained a lot of experience working as a teacher in Kwazulu Natal, where she also studied. Gundo is currently doing her Masters in Mathematics and chose teaching over a corporate occupation.

3.5.6 LIVHUWANI

Mulaudzi is a 43 year old teacher at E Secondary. She has been with the school for 11 years. He has been teaching Mathematics for the past 18 years. He graduated with a Chemistry degree at university.

3.5.7 MAKAITA

Makaita is a 36 year old teacher at D Secondary School. She is from Zimbabwe, where she taught Physics and Mathematics. She has been with the school for five years. Makaita, through her experience and dedication, has developed a solid foundation for Math at the school, especially with the Grade 11 and 12 classes. The male to female mathematics learners ratio was about 85:15 when she arrived, but has since changed it to about 55:45.

3.5.8 MUKOMA

Mukoma is a 27 year old Mathematics teacher at D Secondary, and has been with the school for two years. Mukoma is a qualified teacher who started work as an educator at the age of 22. He is also pursuing a Masters degree in Education.

3.5.9 MULWELI

Mulweli is a 38 year old teacher at E Secondary School. He teaches Mathematics Grade 12 Mathematics alongside another educator. He has been with the school for eight years. He is a qualified teacher with 18 years experience.

3.5.10 MULAUDZI

Mulaudzi is a 43 year old teacher at E Secondary. She has been with the school for the past 13 years. Mulaudzi is a qualified teacher who also has a Masters in Education. Her vast experience and work ethic have made her a well-known teacher in the school and the female enrolment in Mathematics has seen a marked increase each year.

This chapter deals with the analyses of data that emerged from the unstructured interviews and the questionnaire that was distributed to the schools around the Vhembe district.

All of the schools were not fully operational, had electricity, but no running water, not enough classrooms, not enough furniture and chalkboards. The following is the data that was obtained from the questionnaires distributed in these schools:

4.2 Learning and gender differences

Results

Figure 1: Participants (n=161)

CHAPTER 4

4 DATA ANALYSIS

4.1 Introduction

This chapter deals with the analyses of data that emerged from the unstructured interviews and the questionnaire that was distributed to the schools around the Vhembe district.

All of the schools were not fully operational, had electricity, but no running water, not enough classrooms, not enough furniture and chalkboards. The following is the data that was obtained from the questionnaires distributed in these schools:

4.2 Learning and gender differences

Results

Figure 1: Participants (n=161)

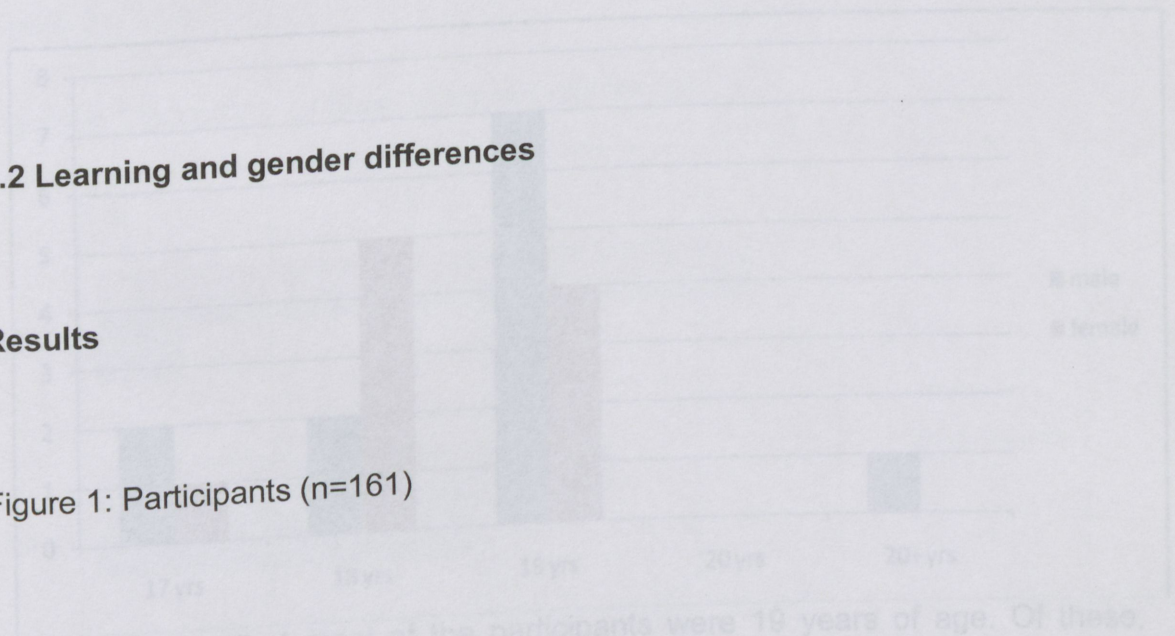


Figure 2 shows that most of the participants were 19 years of age. Of these, males were more than females. Figure 3 below shows that most parents of the learners who participated in this research were labourers. It also indicates that more male professional participants took part in the research. The overall

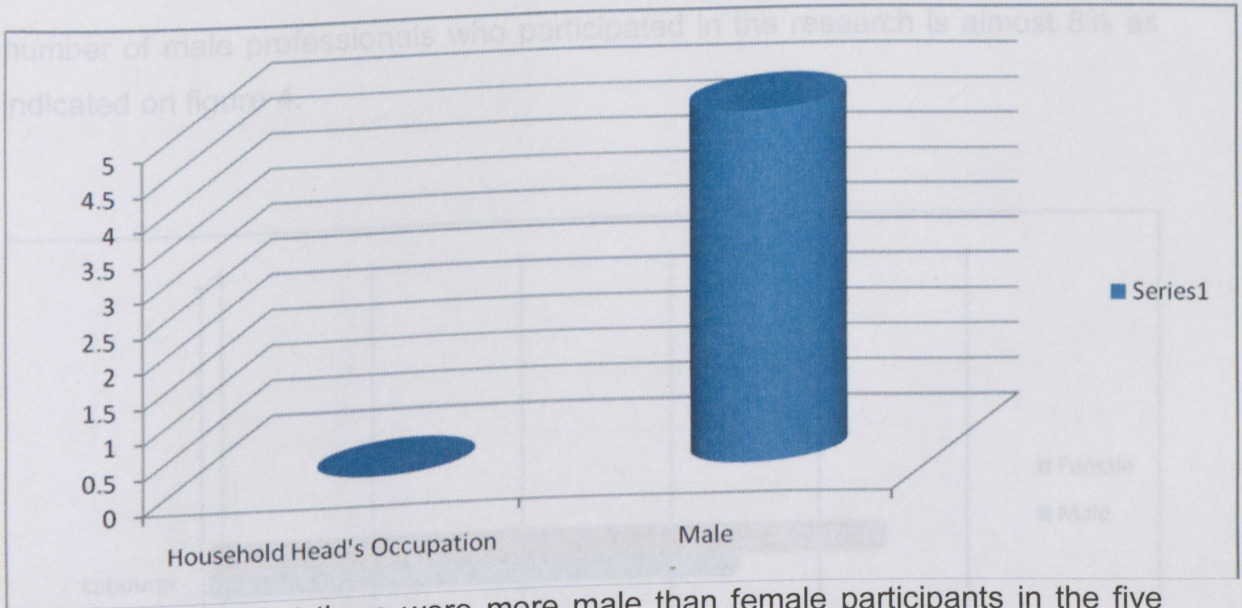


Figure 1 shows that there were more male than female participants in the five schools.

Figure 2: Participants by age (n=161)

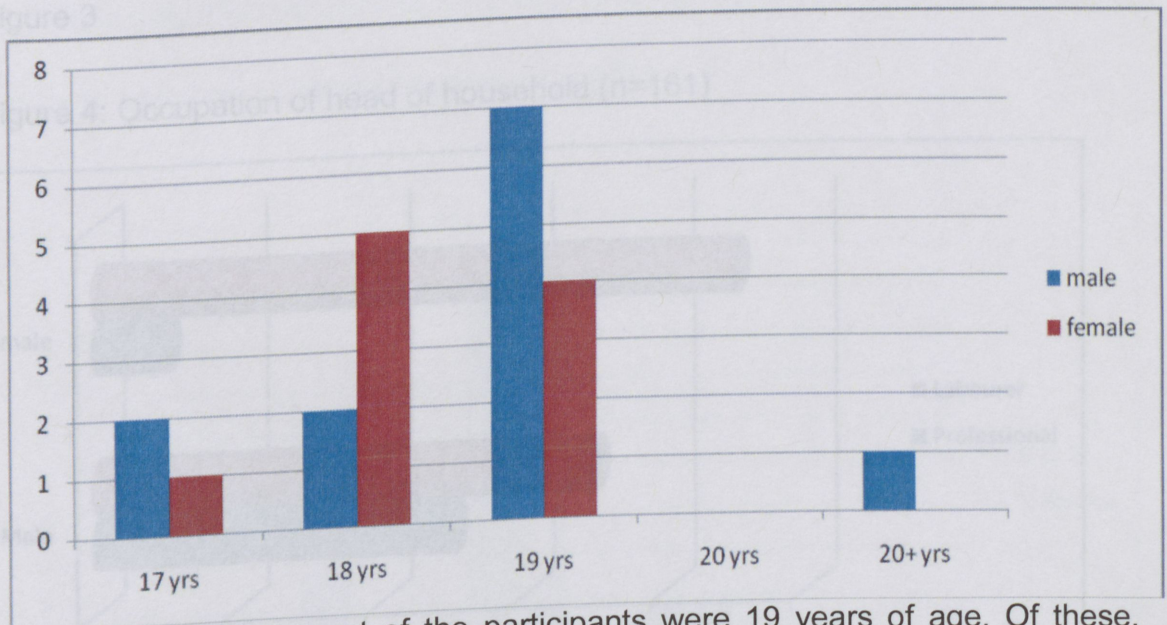


Figure 2 shows that most of the participants were 19 years of age. Of these, males were more than females. Figure 3 below shows that most parents of the learners who participated in this research were labourers. It also indicates that more male professional participants took part in the research. The overall

number of male professionals who participated in the research is almost 8% as indicated on figure 4.

Figure 3: Household income (n=161)

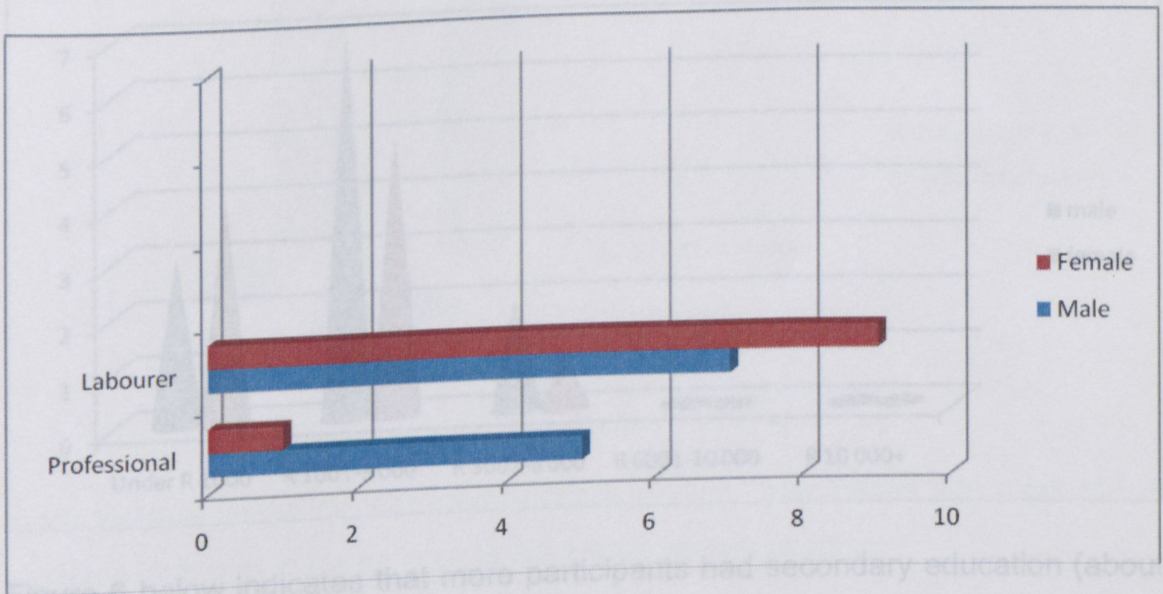


Figure 3

Figure 4: Occupation of head of household (n=161)

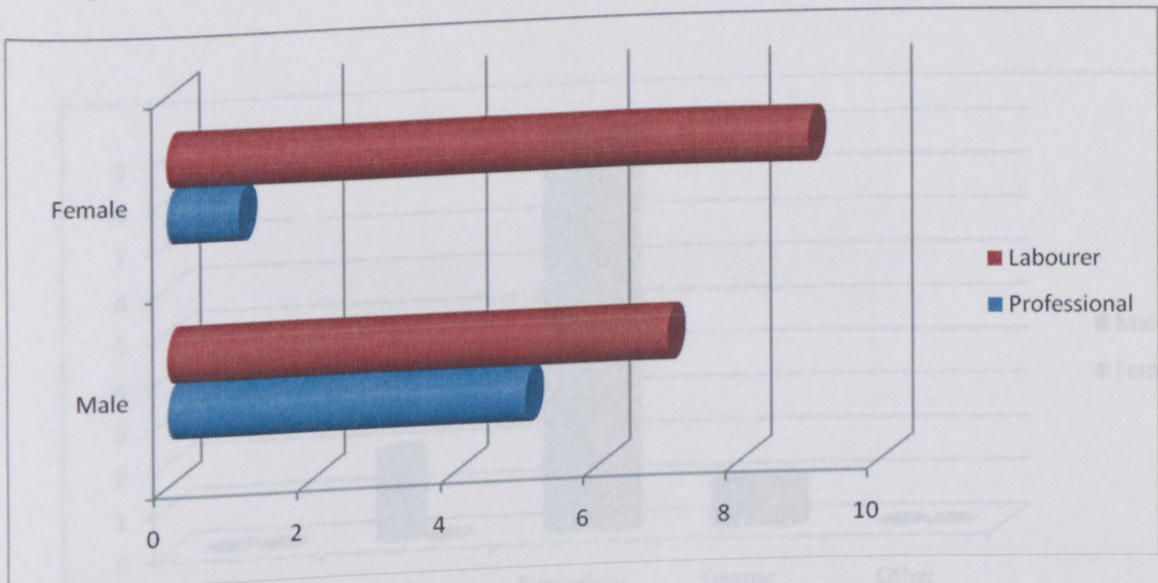


Figure 5 also indicates that Males are still being paid more than their female counterparts in their professional occupations.

Figure 7: Families with a housekeeper (n=161)

Figure 5: Household income (n=161)

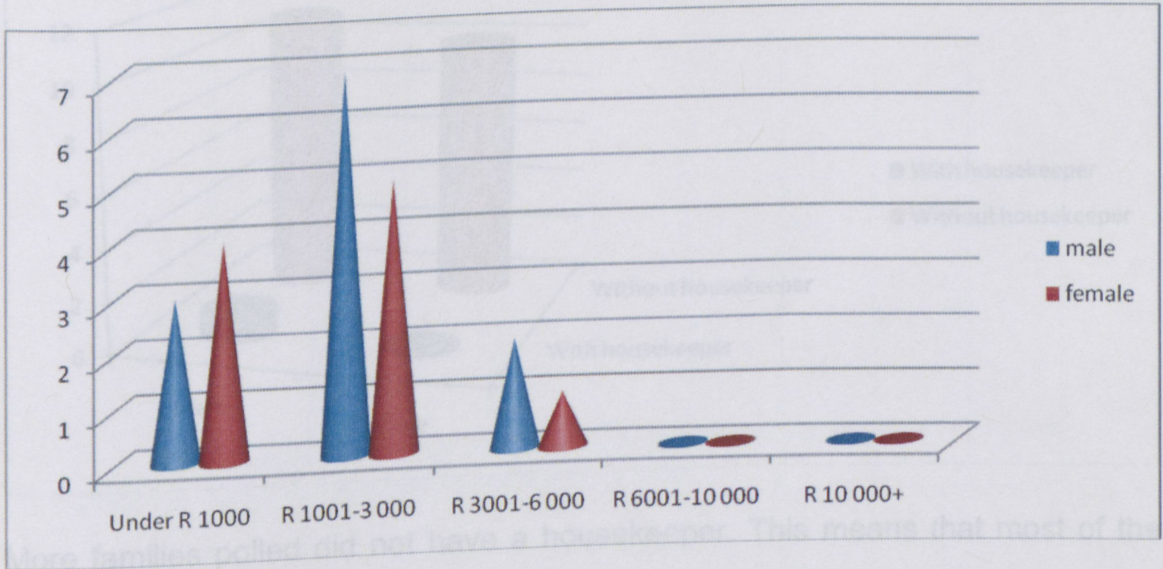


Figure 6 below indicates that more participants had secondary education (about 9%) while only 1% managed to have their first degree.

Figure 6: Level of education of parents (n=161)

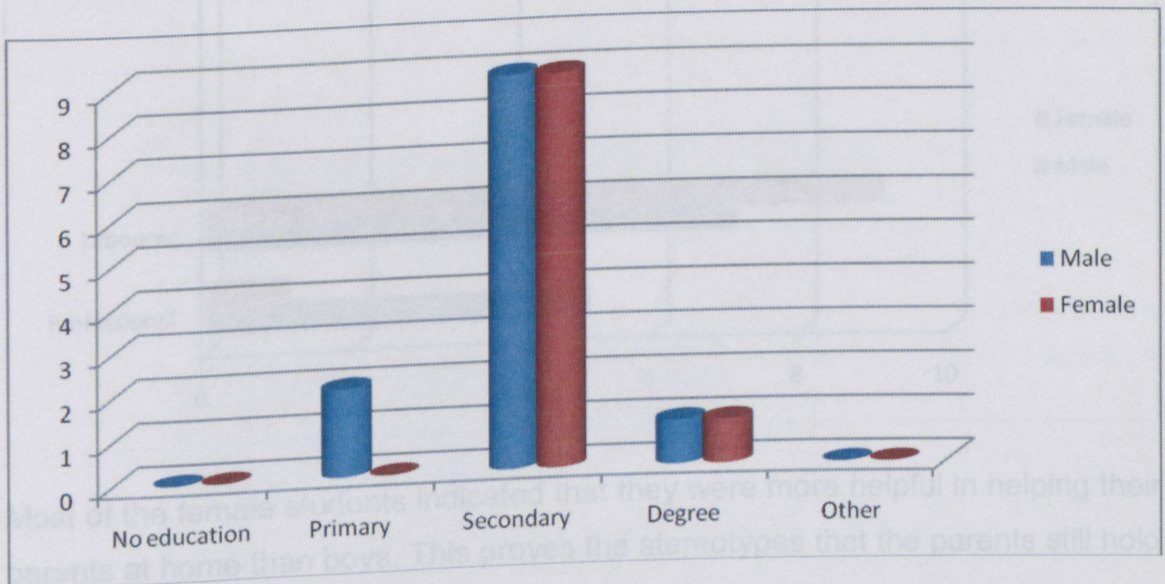
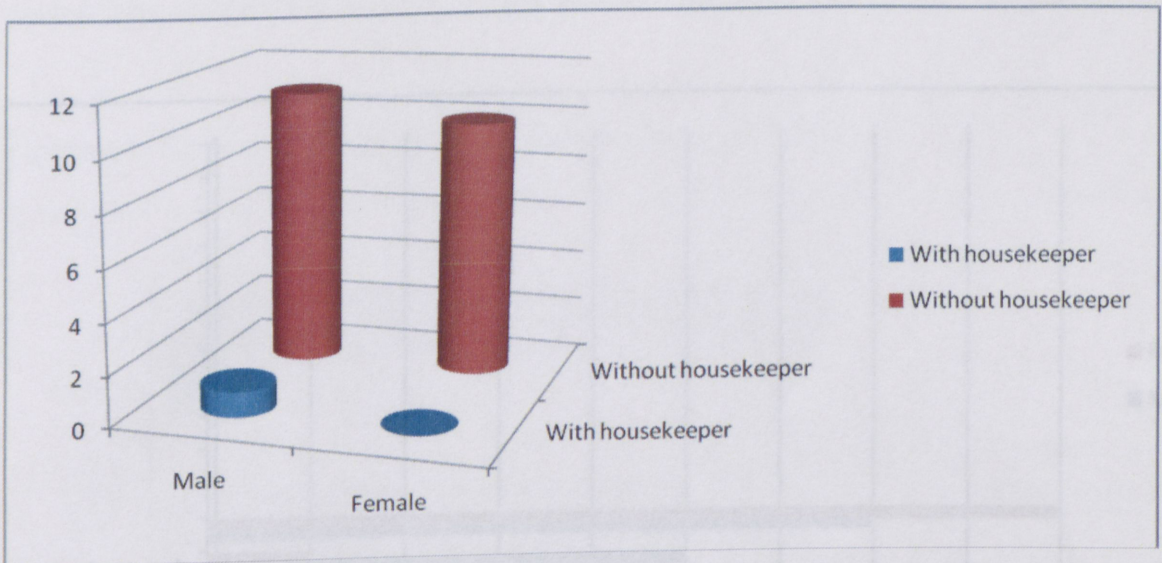
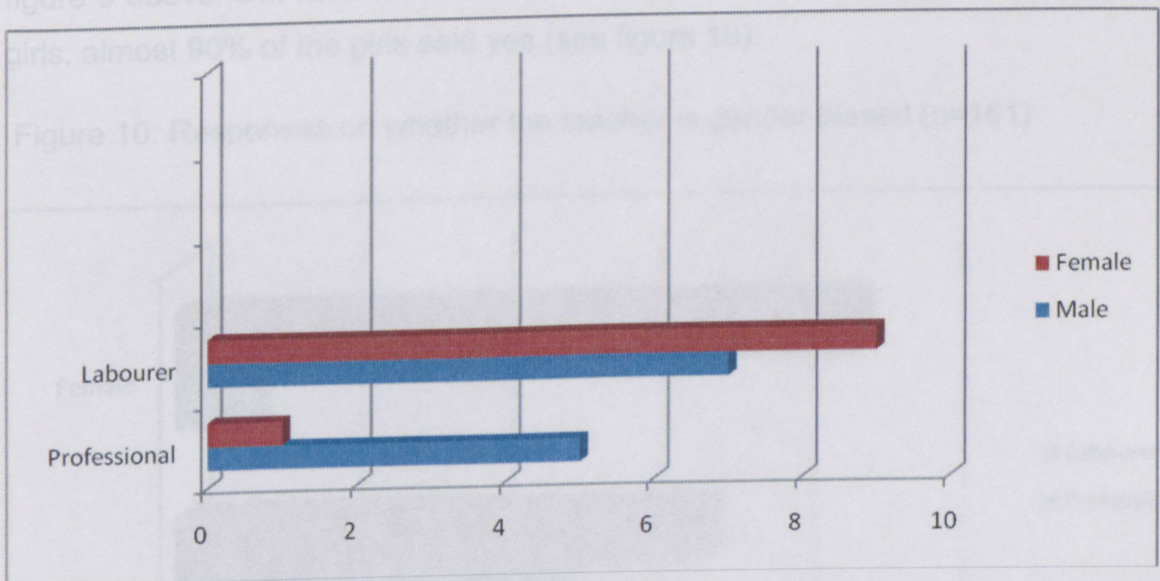


Figure 7: Families with a housekeeper (n=161)



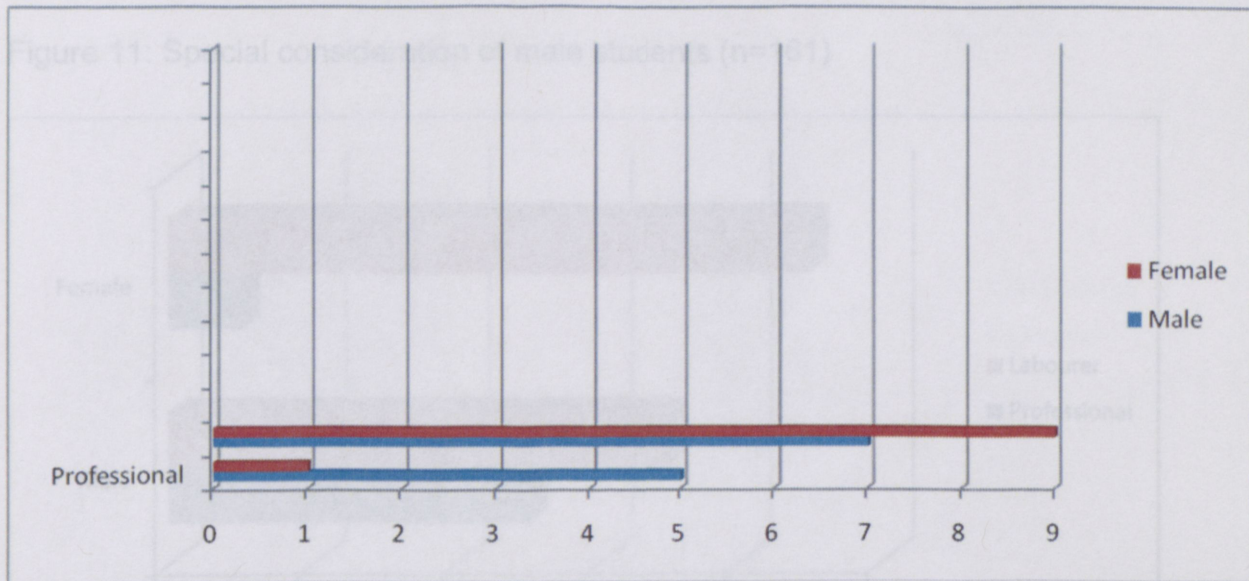
More families polled did not have a housekeeper. This means that most of the students took part in taking care of the house chores at home.

Figure 8: Chores done after school (n=161)



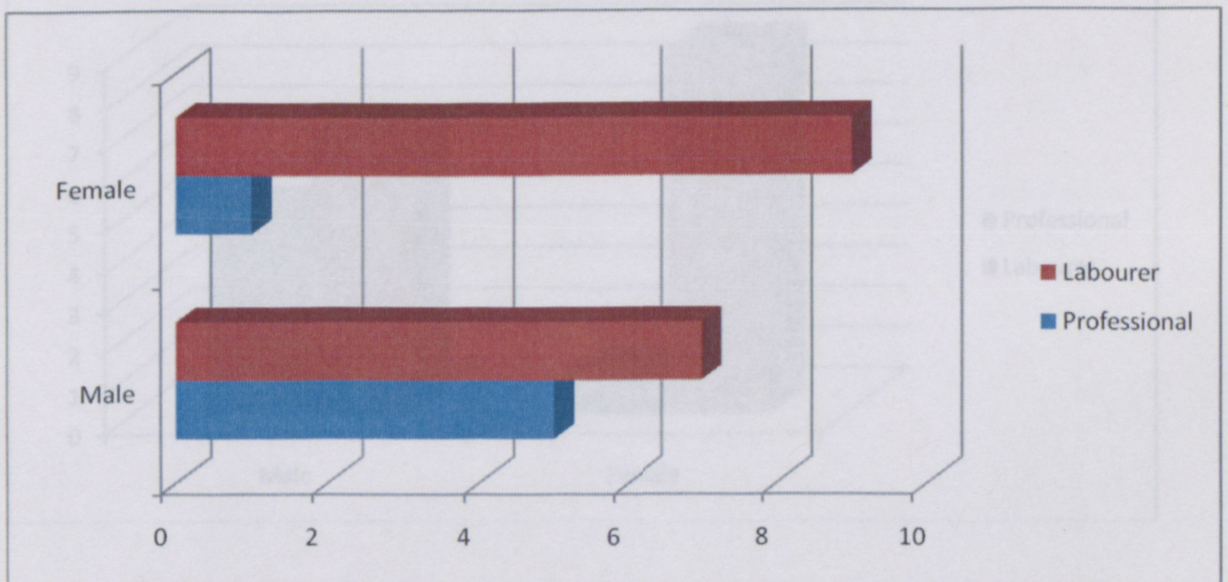
Most of the female students indicated that they were more helpful in helping their parents at home than boys. This proves the stereotypes that the parents still hold in as far as duties for boys and girls are concerned at home.

Figure 9: Careers aspired



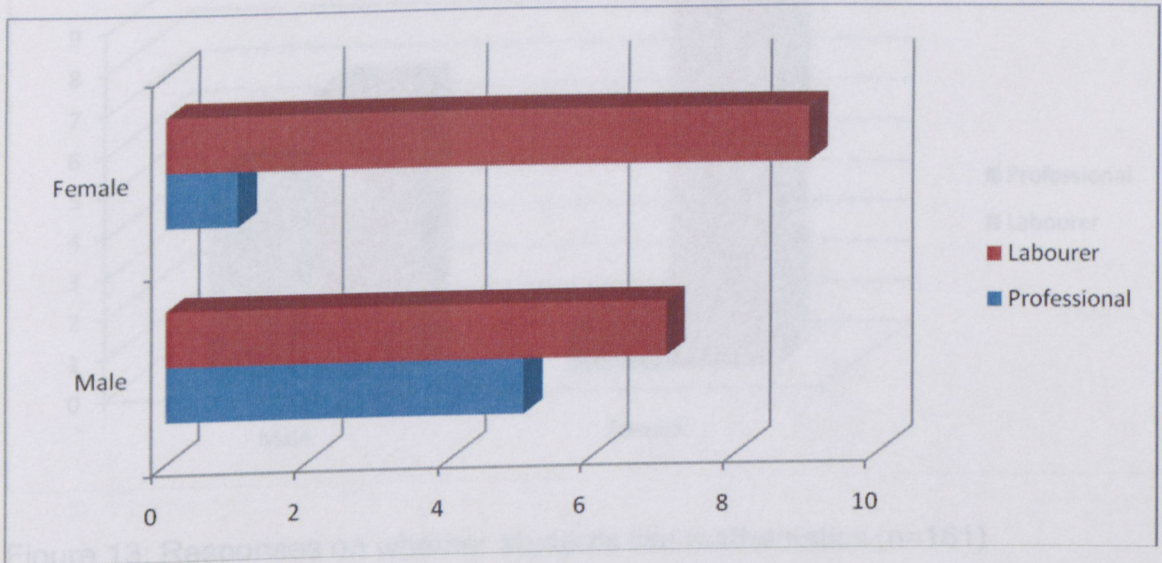
More female students aspired to become professionals than boys, as shown on figure 9 above. But when asked as to whether their students are biased against girls, almost 90% of the girls said yes (see figure 10).

Figure 10: Responses on whether the teacher is gender biased (n=161)



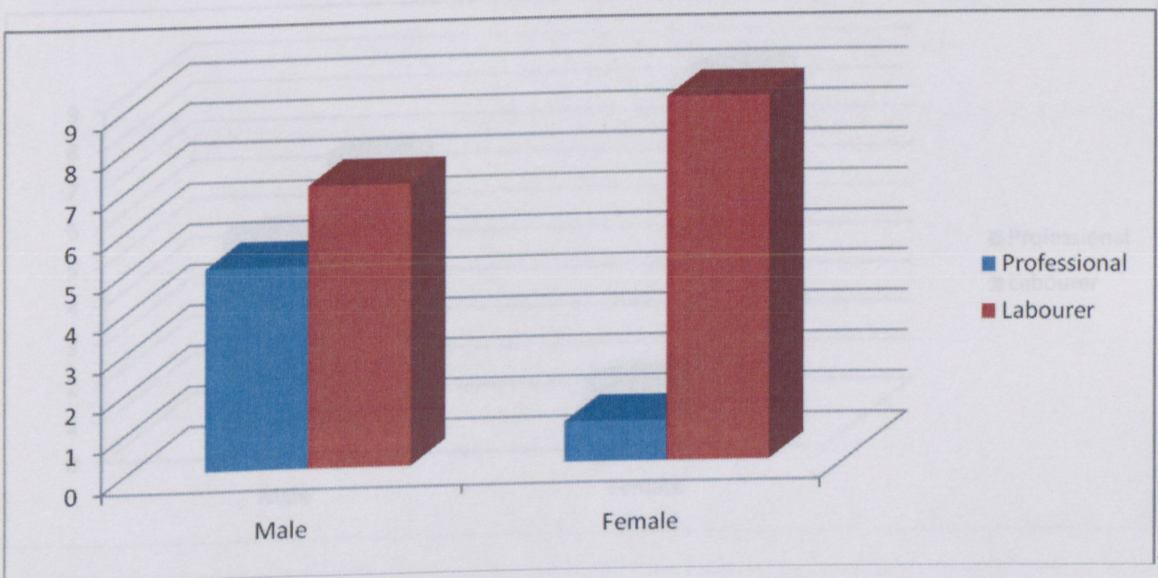
Most of the respondents held the belief that boys are given more attention in the classroom, especially when it comes to subjects such as mathematics. them to do so.

Figure 11: Special consideration of male students (n=161)



In addition, more female thought the mathematics is such a cool subject, unlike the other subjects.

Figure 12: Willingness to choose mathematics as a career (n=161)



Be that as it may, more girls reported that they are willing to choose mathematics as a career in the future only if the teachers and the parents could encourage them to do so.

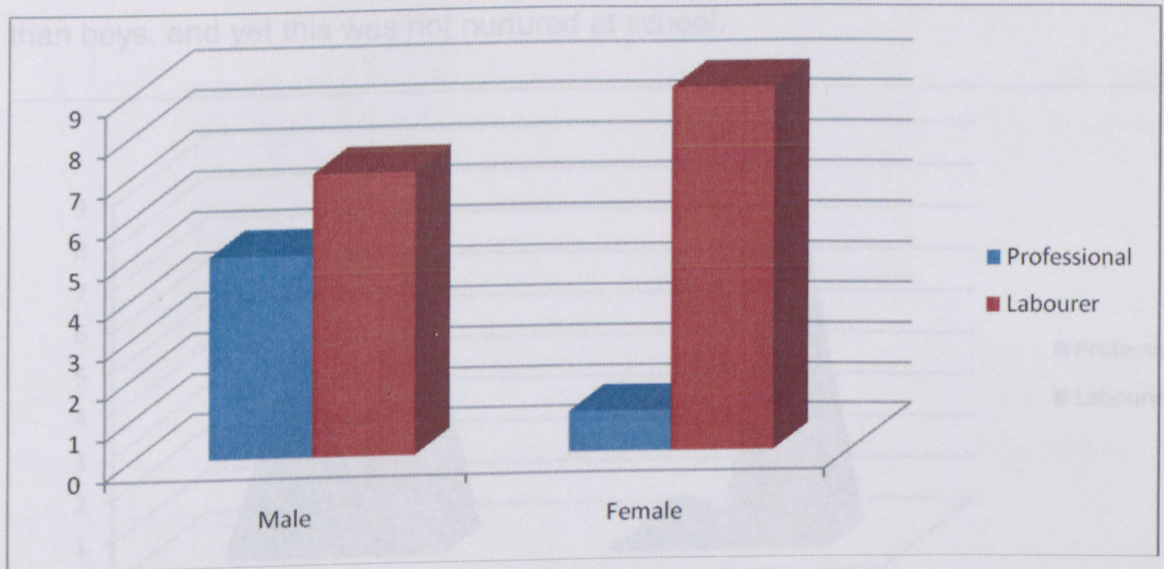


Figure 13: Responses on whether students like mathematics (n=161)

In addition, more female thought that mathematics is such a 'cool' subject, unlike other subjects that requires intense reading.

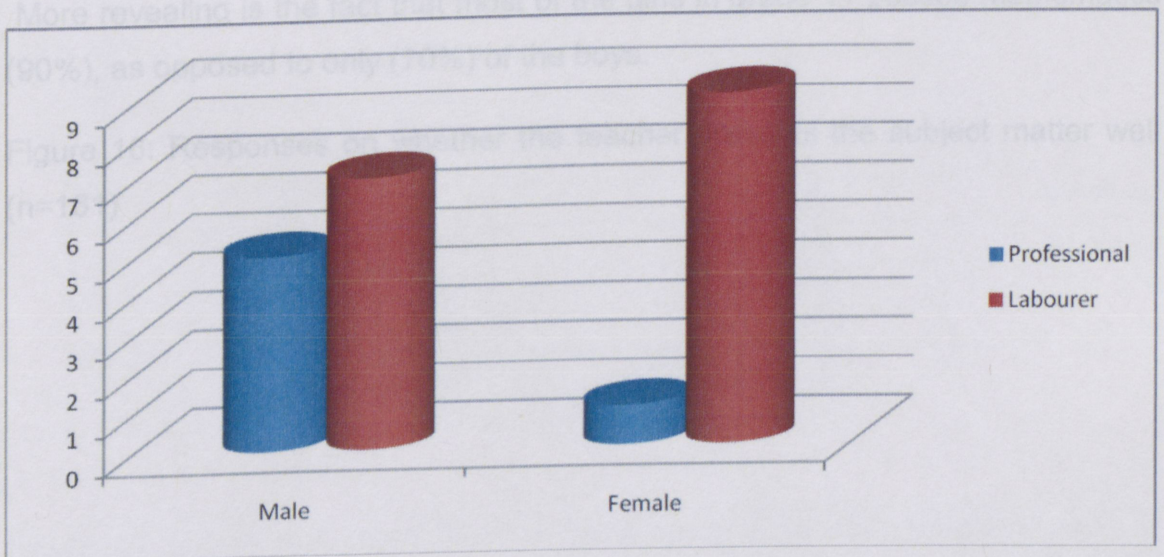


Figure 14: Responses on whether it is easy to pass a mathematics course (n=161)

Another startling finding is that girls found it easier to pass mathematics subject than boys, and yet this was not nurtured at school.

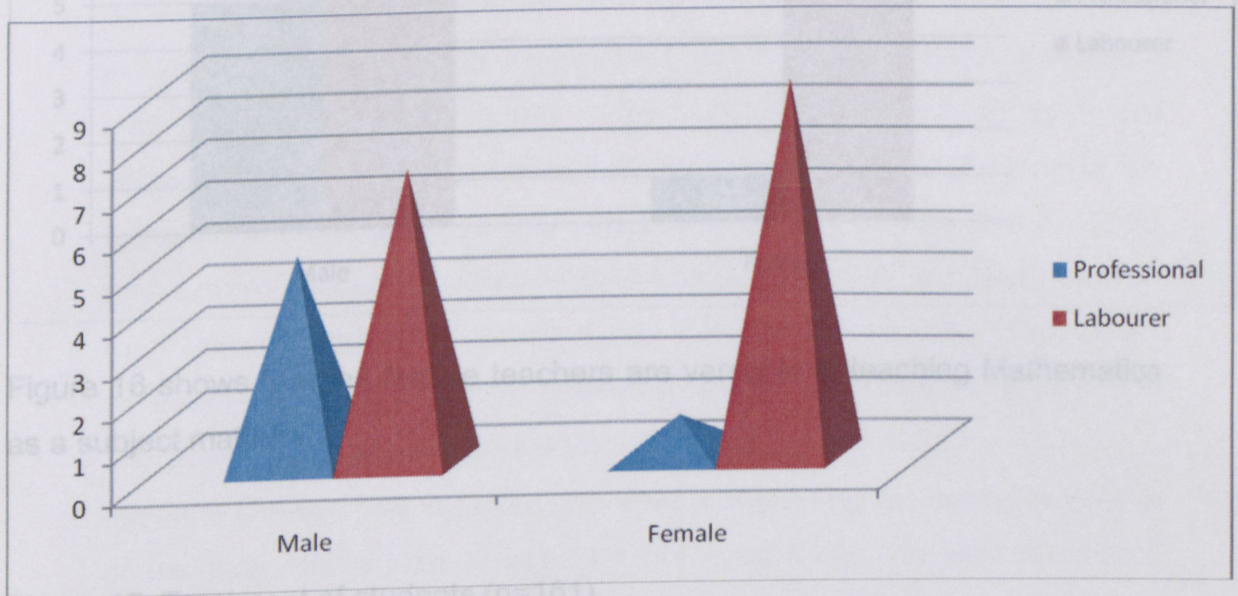


Figure 15: Grade 11 final examination mathematics mark (n=161)

More revealing is the fact that most of the girls in grade 11 passed Mathematics (90%), as opposed to only (70%) of the boys.

Figure 16: Responses on whether the teacher presents the subject matter well (n=161)

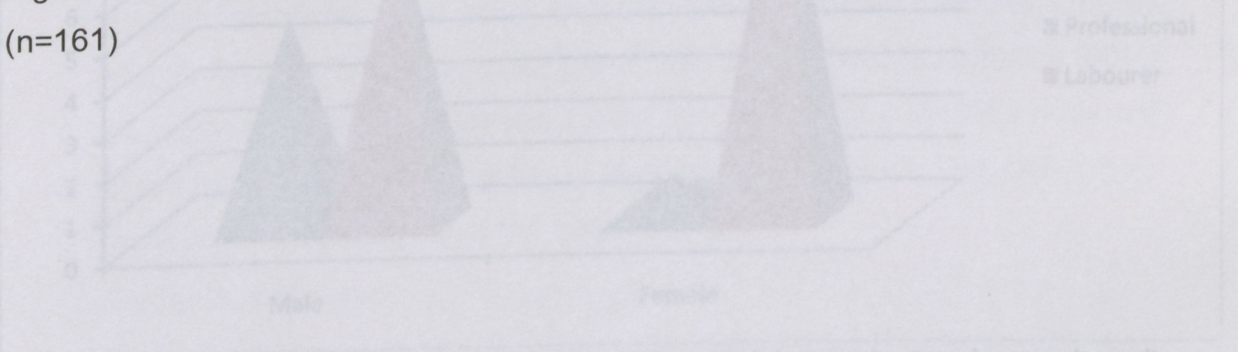


Figure 17 shows that more females were ignored by male teachers when it comes to the teaching of Mathematics. This proves that there are deep-seated patriarchal value systems that teachers are still battling with.



Figure 16 shows that the female teachers are versatile in teaching Mathematics as a subject matter.

Figure 17: Treatment of students (n=161)

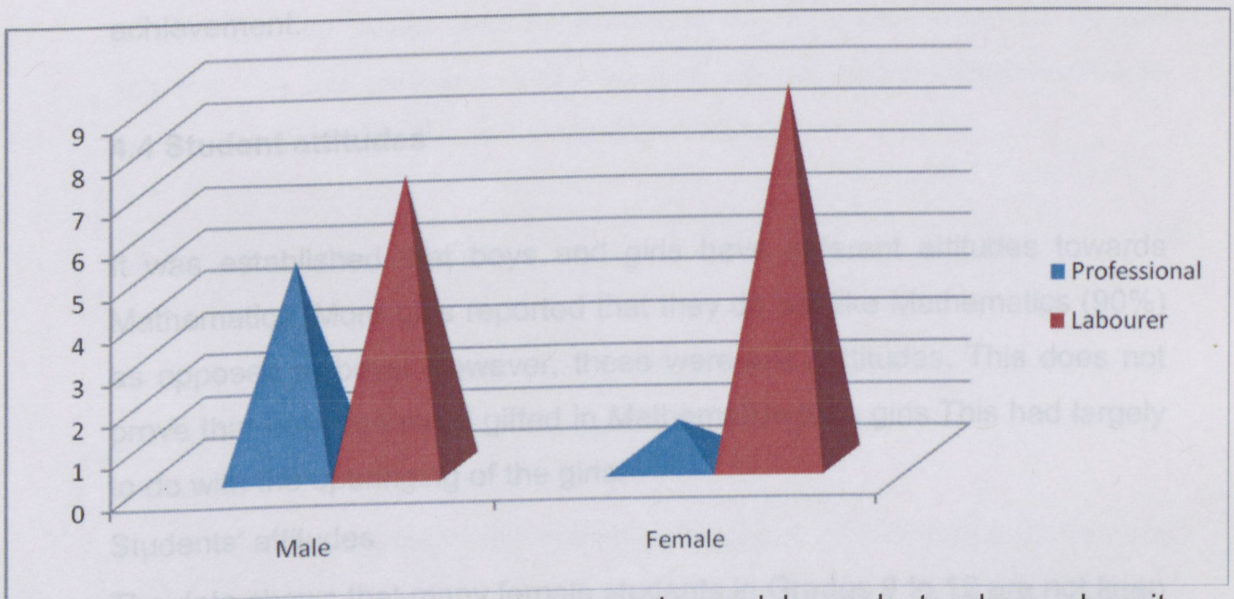


Figure 17 shows that more females were ignored by male teachers when it comes to the teaching of Mathematics. This proves that there are deep-seated patriarchal value systems that teachers are still battling with.

4.3 Parental involvement

The data analyzed so far indicate that parents are more restrictive and more nurturing with their daughters but only encourage their boys/sons to be free and explore more in terms of mathematics in and out of school. It is established that parents' involvement may influence children's attitudes such as self-concept which may, in the final analysis affect their academic achievement. It was established that most parents restrict the girls in out extra-mural activities while boys were encouraged to take part in sports and extra-curricular activities which have been proven to be essential in the intellectual growth of the students. Data also proved that sons talked to their fathers more, and encouraged them to explore and to be analytical, while girls were encouraged to do what was called feminine chores. This impeded girls ever considering Mathematics as one of the subjects to take at school. This means that the parents should intervene early in the preparation of their children's educational achievement.

4.4 Student attitudes

It was established that boys and girls have different attitudes towards Mathematics. More girls reported that they do not like Mathematics (90%) as opposed to boys. However, these were just attitudes. This does not prove that boys are more gifted in Mathematics than girls. This had largely to do with the upbringing of the girls.

Students' attitudes

The data shows that many female students in Grades 9 to 12 are not keen on taking mathematics because of the gendered nature of education in the country. The girls in all the schools indicated a strong affinity to high verbal

skills. This might stem from the fact that most of the girls discuss more with their mothers about their favourite subjects and what they would like to do when they are older. As a result of this stronger supportive verbal relationship with their parents, they ultimately believe that Mathematics is for boys.

4.5 The attitudes of teachers

Data proves that the teachers' attitudes toward girls in all the schools work against girls' tendency to perform less well than boys in Mathematics. Most of the females reported negatively about teachers when asked if they were motivated to take mathematics as a subject at school. As a result, girls were more afraid than boys to ask questions in mathematics classes, and had a lower self-concept about Mathematics. However, it was also proven that more of those girls who ventured to study mathematics were scoring higher grades than boys (as shown in Figure 14, 15, and 16). This proved beyond doubt that Mathematics as a subject was not gender specific. On the contrary, it proved that we are socially constructed to believe that Mathematics is the domain of boys.

4.6 Views of the participants

The teachers that were interviewed had similar views. They believe that girls tend to shy away from Mathematics and rather prefer subjects that are 'easier' and less quantitative.

With a fair representation of females in the group of Mathematics teachers however, it is believed that this fear is slowly being eradicating with time. The number of female Mathematics teachers has increased over time, and

this has motivated female students to enroll for the subject, seeing that they can relate to their female educators.

However, most teachers did indicate that they still struggled to accept the idea that females can perform well in Mathematics, because of the ideologies of society and the way females were raised. Hence it does seem that the greater part of the observed difference in performance between the two genders can be attributed to the attitude of students, teachers, as well as parents.

The teachers indicated that most female students usually carry family chore burdens, and negative talk from parental figures about education usually leaves little room for girls to cultivate an appreciation for Mathematics. Most teachers raised the issue of self esteem and did agree that the school and home system as it stands, favours the development of male students over females as society still sees males as the alpha gender.

4.7 Conclusion

It goes without saying that parents and teachers play an important role in the socialization of the children. It is therefore imperative that they should play a part in shattering the myth that mathematics is for boys. Gender stereotypes about any subject at school should also be debunked.

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Appendix

Questionnaire to investigate gender-based differences in the learning of mathematics

Please indicate your response by placing a cross in the appropriate block and write in short where asked.

1. Gender (Please specify)

Male

Female

2. Age

17

18

19

20

Other (please specify)

- (a) 3001-5000
- (b) 5001-10000
- (c) Over 10000

3. Including yourself, how many people are in your household?

(a) One.....

(b) Two.....

(c) Three....

(d) Four.....

(e) other

.....
Specify)

4. What is the present occupation of the head of your household?

(a) Professional

(a) Yes

(b) Labourer

8. How many hours do you do after school?

(a) None

5. Please indicate your total household income

(a) Under 1000

(b) 1000-3000

(c) 3001-6000

(d) 6001-10000

(e) Over 10000

6. Please indicate the highest level of education for your parents

(a) No education

(b) Primary Education

(c) Secondary education

(d) Degree

(e) Other

Specify).....

.....

.....

.....

7. Do you have a housekeeper at home?

(a) Yes

(b) No

18. What was your Mathematics Marks in Grade 11 final examinations?

(a) Under 30%

(b) 30-40%

(c) 41-50%

(d) 51-60%

(e) 61-70%

(f) 71- 80%

(g) Above 80%

19. is your Mathematics teacher Male or Female?

(a) Male.....

(b) Female.....

20. Do you think the subject matter is presented well by the teacher?

(a) Yes.....

(b) No.....

21. Are boys and girls in your class treated the same way by your Mathematics teacher?

(a) Yes.....

(b) No.....

22. Do you like your Mathematics teacher?

(a) Yes.....

(b) No.....

23. Do you have all the resources you need in your Mathematics studies?

(a) Yes.....

(b) No.....

24. How many times do you practice Mathematics in a week?

(a) None.....

(b) One.....

(c) Two.....

(d) Three.....

(e) Four.....

(f) Five.....

(g) Other
(specify).....

.....
.....
.....

25. Which percentage do you think you will get in your Mathematics final examination?

(a) Under 30%

- (b) 30-40%
- (c) 41-50%
- (d) 51-60%
- (e) 61-70%
- (f) 71-80%
- (g) Over 80%

Thank you for your time.