

**SOCIO-CULTURAL FACTORS INFLUENCING THE  
PROGRESS OF GIRLS IN THE FIELD OF SCIENCE  
AND MATHEMATICS IN NAMIBIA**

by

**COLEN TUAUNDU**

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I, Tuaundu Colen, hereby declare that **“SOCIO-CULTURAL FACTORS INFLUENCING THE PROGRESS OF GIRLS IN THE FIELD OF SCIENCE AND MATHEMATICS IN NAMIBIA”** represents my own work and all the sources that I have used or quote, have been indicated and acknowledged by means of complete reference.

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**SIGNATURE**

**(Mr C TUAUNDU)**

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**DATE**

## **DEDICATION**

**This work is dedicated to my late beloved mother, Inaamuari Contansia Katuaundu, and the Namibian education sector.**

## **ACKNOWLEDGEMENTS**

**I would like to extend and express my sincere appreciation and gratitude to all those who helped me in completing this project. In particular I would like to thank the following:**

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## **Abstract**

The fewer numbers of girls that take part in Mathematics and Science programmes than those of boys in Namibia prompted this study. Few Namibian students pass Grade 12 Mathematics and Science with symbols required by the University of Namibia and other higher educational institutions in Africa and abroad. When the numbers of male students and female students who graduate both at secondary school and university levels are compared, it becomes clear that very few female students graduate.

The study investigated how socio-cultural factors influence girls' participation in Mathematics and Science. Information used in this study was collected from 1442 girls from 14 schools in Hardap and Khomas regions. Literature has demonstrated the importance of self-concept, motivation and influence from parents and teachers as imperative factors for a change in girls' perceptions of Mathematics and Science. The analysis showed that both beliefs and attitudes of girls are negatively influenced by some cultural and traditional norms. Additional barriers include lack of support from parents, teachers and peers as well as the masculine face that is given to Mathematics and Science. The investigation also revealed the need to motivate girls from an early age. This can be done by empowering and preparing them socially, physically and mentally in these fields. Motivating female students can also be achieved with the help and support from parents, teachers and the entire education sector.

**Topic:**

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***STUDENT NUMBER 33584303***

***UNISA***

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# CHAPTER 1

## INTRODUCTION

### 1.1 GENERAL BACKGROUND

Studies done by Guzzeti and Williams (1996:68) and Van Leuvan (2004:248) suggest that high school girls often underestimate their Science and Mathematics competency, feel less adequate, and have lower expectations for success in Science and Mathematics compared to boys. Family expectations can also affect children's attitudes and achievement especially in Science and Mathematics because they promote gender-role stereotypes by encouraging boys to explore, take risks and develop independence while girls are expected to engage in safe and stationary play (Van Leuvan 2004:249). These stereotypical behaviours are sometimes also encouraged and reinforced by educators in classrooms because they have different expectations from boys versus girls in Science and Mathematics classes (Klein 2004:184).

Some studies have explored girls' under-representation in school mathematics and science and have described a range of interventions designed to solve the problem. Other studies have investigated the poor participation of women in tertiary-level mathematics and science studies and mathematics and science related areas of employment (Gilbert and Calvert 2003: 861). Gilbert and Calvert are of the opinion that the assumption that young women in general are unlikely to choose science as a field of study is a misconception that needs to be changed, either by the young women themselves or by the way the subject is presented to women, for example curriculum design, teachers, teaching methods and assessment. They recommend that Science and Mathematics should not be given a masculine image, but should be regarded as a neutral, objective and genderless knowledge which can be acquired by both genders at equal levels. Gilbert and Calvert (2003: 861-878) further state that "We need to observe this issue from a different angle and with a different lens."

Klein (2004:184) on the other hand reported mixed and ambiguous trends of boys and girls with regard to emotional dimensions, morale, learning processes, motivation, behaviour, degree of participation in class, learning activities and areas of intellectual curiosity could assist in solving the problem. The report further suggests that poor Science and Mathematics background, ethnic and socio-economic status, various gender norms and stereotyped expectations could also serve as barriers for girls to actively participate in Science and Mathematics.

There are also beliefs and norms that stem from the family and tradition, in the form of parent-child interactions and expectations, which may contribute towards the misconception that girls are less capable in Science and Mathematics than boys. In this regard, Van Leuvan (2004:249) describes some of the factors that have a negative impact on girls. The factors are:

- parents encouraging the mathematics achievement of boys more than that of girls;
- parents having a more scientific career expectation of boys than of girls;
- science teachers interact more with boys than with girls in the classroom;
- girls called on less frequently and receiving minimal feedback in science classes;
- elementary teachers expecting girls to use set rules and algorithms to do mathematics but allowing boys the independence to invent solutions;
- school counsellors not encouraging girls to enrol in advanced mathematics and science in upper grades, because they view these fields as too difficult or unnecessary for girls; and
- that there are few female role models in the Science and Mathematics fields that can encourage girls to participate in these fields of study.

Support, influence and encouragement from friends, family and communities are also factors that foster gender-equitable perceptions, higher academic achievement and better-self concept in girls. A study by Labudde, Neuenschwander, Herzog and Gerber (2000:143-144) reveals that there should be a strong relationship between content and students' every day experiences. Students who are exposed to technological toys and games, which in most cases are boys, will have greater interest in Science and Mathematics, because of the pre-existing knowledge that they have.

It is internationally recognized that over the last ten years girls' participation in science subjects at senior secondary and tertiary levels in most countries has increased considerably and their levels of achievement are either equal or above that of boys (Gilbert and Calvert 2003:861). In recent years, women have received degrees in most fields in numbers approaching or exceeding 50% with regard to their male counter parts. However, the fields of Science and Mathematics lag behind as professional areas where women have not yet broken the gender barrier (Tai and Sadler 2001:1017). According to Van Leuvan (2004:248), women who pursue science careers mainly choose biological sciences where they represent 40% of the work force, or computer sciences representing 33% of the work force, or physical sciences representing 22% of the work force and engineering representing 9% of the workforce.

However, most researches do not report a corresponding increase in the level of participation and achievements by women, especially in Africa, in scientific and technological sectors of the workforce. The intractability of this problem, especially the socio-cultural factors that prompt women in Namibia not to continue their studies in Science and Mathematics once it is no longer compulsory, is the core aim of this study.

## **1.2 BACK GROUND TO THE RESEARCH PROBLEM.**

Although there has been an improvement in the participation of girls in the fields of Mathematics and Science in many countries, this does not seem to be the case in Namibia. Mbalu (2004:2) reports that Namibia is a country that faces a shortage of female Science and Mathematics graduates both at secondary school and tertiary levels. According to Mwetulundila (2000:23-35), girls in Namibia do not fully participate in science and mathematics because of the following reasons:

- The South African colonial education was inferior particularly with regard to Science and Mathematics.
- The low participation of females is carried-over from secondary schools or high schools.
- The “hidden curriculum”, which not only lacks regarding to what is taught, but also regarding how it is taught and the process of teaching and learning coupled with cultural experiences from home.
- Lack of female role models.
- Socio-economic factors and teenage pregnancy.

Mwetulundila’s (2000) findings prompted this study especially because it left the question of how socio-cultural factors influence girls’ poor participation in Science and Mathematics unanswered. When comparing the University of Namibia’s annual reports from 2002 to 2005, it becomes clear that there is a low enrolment for and a high dropout rate of female students from Science courses at this institution compared to male students. In 2004 the total number of staff at the University of Namibia that were involved in training in Science related fields were 15 of which 10 were male and 5 female, while the students enrolled in Science related fields were 670 of which 407 were male and 263 were female, (Kiangi & Tjiramba 2004:11-12). In 2007 Sebeen (2007:1) reported that the number of science graduates produced in Namibia was insufficient, and would not help to accelerate economic growth and development. At the same time, the Dean for the Faculty of Science at the University of Namibia, Professor Enos Kiremire (Sebeen 2007:1), reported that the university had produced

only 500 science graduates in 12 years, which implies that not all who enrol eventually graduated. If Namibia is to realise its Vision 2030, it has to produce 600 research scientists and engineers per year, as the rate of Japan was in 1993, (Sebeen 2007:1). At its inception in 1993, the Faculty of Science at the University of Namibia enrolled 144 undergraduate students. By 2003 the intake figure rose to 670 and in 2005 the figure was 805. While the number of graduates in 1993 stood at only six males and four females, this figure improved to 37 males and 39 females in 2003 and to 32 males and 44 females in 2005 (Kiangi and Tjiramba 2005:13).

In general, Laubscher (2007: 6) reported that women only form 15% of the scientific field in Africa and only 1% of them are in leadership positions. The figures look even more shocking when males and females are compared at school level. The Association for the Development of Africa (ADEA) and the Forum for African Women Education (FAWE) indicate that only 22% of girls in Africa attend secondary school and only 10% of the 22% study science related topics (Mwetulundila 1999:35). These phenomena are fuelled by the fact that female learners and students both at secondary school and tertiary levels have negative perceptions about science fields (Mwetulundila 1999:36.). This negative perception has resulted in the Science sector being dominated by males. Even if affirmative action and gender equality are implemented, the situation will not be rectified because there is a lack of qualified females to take up the challenge. The affirmative action and gender equality policies are heavily hampered by the fact that there are so few female graduates. Statistics show that in Namibia only one third of the girls entering secondary school complete their schooling with good science knowledge and grades. The figures are worse at tertiary level where only one out of twenty graduates is female (Ministry of Education Report 2000:75).

The Journal of Indigenous Namibians in Mathematics, Science and Technology examined the causes of women's under representation in science related fields in Namibia (Ndunda 1999: 99). The study did not consider how social-cultural factors



and traditions in Namibia affected female students. Although several studies in this field have produced some interesting data, it leaves out a range of other factors which might contribute to the prevailing problem of under-representation of women in Science and Mathematics. This study aims to find out how socio-cultural factors such as experience, culture, norms, tradition and beliefs influence girls when deciding whether to enrol or not to enrol for Science and Mathematics at a higher level in Namibia.

### **1.3 STATEMENT OF THE PROBLEM**

According to Ndunda (1999:25), approximately 87% of students doing Mathematics and Science at school and university levels combined in Namibia in 1998 were male. He also reported that, between 1992 and 1998, only 5% of the graduates in Science and Mathematics were women at the University of Namibia. The question that needs to be addressed is: Why do girls/female students shy away from Mathematics and Science at lower levels and why do female students not take Science and Mathematics as their major subjects at tertiary level in Namibia (Sebeen 2007:1)?

As mentioned above, this problem has been studied from a various angles. However, the negative effects of socio-cultural factors towards the problem in Namibia have not been addressed sufficiently. There is need to show how socio-cultural factors such as traditions, culture and beliefs influence girls in the fields of Science and Mathematics in Namibia. This is the main aim of this study and it is hoped that the findings made in this study are likely to be part of the solution to this problem.

### **1.4 AIM AND OBEJECTIVES**

The main aim of this study was to explore and identify the influence that socio-cultural factors have on girls' perceptions and participation in the fields of Mathematics and Science in Namibia.

The objective of the study was to establish the socio-cultural factors which negatively influence girls in their perceptions and understanding of Science and Mathematics.

## **1.5 MAIN RESEARCH QUESTION**

The main research question of this study is: What negative or positive socio-cultural factors hinder girls to progress in Science and Mathematics fields in Namibia?

### **1.5.1 Research sub-questions**

There are five sub-questions to be addressed in this study.

1.5.1.1 What positive or negative influences do girls have about Science and Mathematics from parents and teachers?

1.5.1.2 What cultural or traditional inheritable norms hinder girls' interest in Science and Mathematics?

1.5.1.3 What positive or negative beliefs and self-image do girls have about Science and Mathematics?

1.5.1.4 What are the attitudes of girls towards Science and Mathematics?

1.5.1.5 What type of tinkering activities are girls exposed to and how do they influence them towards Science and Mathematics?

## **1.6 THE SIGNIFICANCE OF THE RESEARCH**

Ndunda (1999:36) examines the unequal gender representation in the Science and Mathematics sector, but the effect of socio-cultural factors and how they might influence girls in these fields is omitted in the study. A start could be made towards solving this problem by making a contribution towards the understanding of the theory and knowledge about the participation of girls in Mathematics and Science and identifying socio-cultural barriers that make it difficult for girls to take part in Mathematics and Science programmes in Namibia. This could open new possibilities for the teaching of Science and Mathematics to girls in Namibia. This study provides useful information for teachers, society, school administrators and curriculum developers. It can contribute to the improvement of policies that address the problems girls face in this field. By clarifying the effect of socio-cultural factors in different traditions in Namibia, awareness could be brought to girls and educators in Namibia

regarding what could be done to improve their participation in Science and Mathematics.

## **1.7 RESEARCH PLAN**

This chapter has highlighted the research question and the corresponding sub-questions. Chapter 2 presents a review of the literature and Chapter 3 the research methodology. The analysis of data is done in Chapter 4. Chapter 5 provides a summary of the research, conclusions and recommendations of the study.

## **CHAPTER 2**

### **REVIEW OF LITERATURE**

#### **2. 1 INTRODUCTION**

In this chapter a selection of literature that has been generated on the issues of women and Science and Mathematics is reviewed with special focus on socio-cultural aspects. At the outset, it is worth mentioning that in Namibia there is lack of literature regarding the issues of women and Science and Mathematics. This means that the researcher depends heavily on foreign literature. According to Johnson and Christensen (2000:152), primary and secondary sources should be carefully chosen, studied and investigated with the purpose of drawing out only the essential information that is present, reliable and applicable to the current study. The literature review thus concentrates on the socio-cultural factors that might contribute or hinder the progress of girls in Science and Mathematics. The review of literature is organised to cover the general, national and African research findings regarding culture, traditions and Science and Mathematics issues.

#### **2.1.1 Socio-cultural framework**

Within the socio-cultural framework of this study, culture is understood as the objective force that infuses social relationships, social development and the development of a disciplined society. Culture in its broadest sense is cultivated social behaviour through learning. The essential core of culture consists of traditional ideas and their attached values, attitudes, knowledge and skills. Culture is essential to this study because children's cognitive development and functioning are highly influenced by social events that a person is exposed to (Mwamwenda 2005:89) and these originate from the culture, social environment and traditions that one is exposed to.

Culture is learned and it is created by people and it exists in time and space, that is, in an environment in which human beings act and respond upon their space, time dimension, their thought about things, themselves and others. In this study culture has three dimensions, artifacts (that which is made, created and produced), sociofacts (the way in

which people organise their society and relate to one another) and mentifacts (the ideas, beliefs and values that people hold). Culture is further understood as having three other levels, for example, national level (the nation as a whole), regional level (associated with ethnicity, language and religion) and lastly gender level (associated with female vs. male).

Social environment in this study refers to how people and communities behave, their relationship, education and occupation, and the conditions in which they live. It is imperative to note that elements of the social environment overlap and interact with the natural environment.

Tradition is a practice, custom or story that is memorised and passed down from generation to generation, originally with no need for a written system. Traditions are so imperative to this study because they are seen as transferred knowledge, which can shape, change and control the conduct of girls in Mathematics and Science. Some traditions may be more open and accommodative for girls to study Mathematics and Science while others may not be.

### **2.1.2 Myths about the participation of girls in Mathematics**

In recent years, women have received degrees in most fields in numbers approaching or exceeding 50% of the general academic population (Dovi 2004:1). However, professions relating to Mathematics and Science remain as professional areas where women have not yet broken the gender barrier (Tai and Sadler 2001: 1017).

A number of popular myths have become a barrier in the pursuit of Mathematics and Science by women. For example, it is said that it is impossible for women to participate actively in scientific work while at the same time maintaining an integrated internal representation of themselves as women (Gilbert and Calvert 2003:864). Another myth links the high performance of girls in Mathematics and Science with hard work and not with rationality or proper reasoning (Tai and Sadler 2001:1016). Gilbert and Calvert (2003:864) point out the devastating consequence of these myths because they encourage the idea that Mathematics and Science is the domain of men and not meant for normal women. These

are myths that need to be change either by the young women themselves or by the way the subject is presented to women (Dovi 2004:1). Mathematics and Science should not be given a masculine image; it should be regarded as a neutral, objective and genderless knowledge which can be acquired by both sexes at equal levels. Gilbert and Calvert (2003: 861-878) maintain that “We need to observe this issue from a different angle and with a different lens.” The aim of this study is to look at the issue from a socio-cultural angle. According to Zohar and Sela (2003:247) and Klein (2004: 185), some of the socio-cultural aspects that need to be considered are:

- the self-confidence of girls regarding Mathematics and Science;
- the difference in pre-existing knowledge between girls and boys and their different ways of learning;
- parents’ expectations towards their daughters and sons;
- the decline of interest in Mathematics and Science especially in girls;
- the problem of culture, gender stereotypes and school science;
- teachers’ attitudes towards girls doing science; and
- changes in different interactions of teachers with boys and girls in science classes.

### **2. 1. 3 General research findings**

The falling number of male and female student, choosing to pursue studies in Mathematics and Science has become a matter of societal concern and debate in many countries (Osborne, Simon & Collins 2003: 1049). Most of the countries which participated in the Third International Mathematics and Science Study (TIMSS) have experienced a degree of gender imbalance in the results for Mathematics and Science with Israel having the largest gender imbalance especially in Grades 7 and 8 of the middle school (Zohar and Sela 2003: 245). This has prompted many governments and ministries of education to attempt to increase the awareness of and recognition of the importance of mathematical and scientific knowledge and its cultural significance for the development of their economies. Although a significant increase in the participation of women in Mathematics and Science has been recorded internationally, it has not been accompanied by a corresponding increase in the

level of participation and achievement by woman in the scientific and technological sectors of the workforce (Osborne et al. 2003: 1045).

Some researchers indicate that girls' beliefs and attitudes contribute most to their Mathematics and Science interests and experience (Hanson 1996:56; Kahle, Parker, Rennie and Riley 1993: 379-404; Mayer and Khoehler 1990:60-95), while Van Lauven (2004: 249) argues that girls often underestimate their Mathematics and Science competence, feel less adequate, and have lower expectations for success in Mathematics and Science when compared to boys. Other factors considered having an impact on gender stereotyping regarding Mathematics and Science are:

- the different interactions of teachers with male and female students (Brophy 1985:115-142);
- teachers' attitudes towards girls and technology (Haggerty 1995:1-15);
- parents' expectations regarding their daughters and sons (Eccles and Jacobs 1986:367-380); and
- differences in pre-existing knowledge between boys and girls and their different ways of learning (Sjoberg and Imsen 1988:218-248; Roychoudhury, Tippins and Nichols, 1995:897-924).

Other authors like Maccoby and Jacklin (1992:20-133), David, Ginorio, Hellenshead, Lazarus, Rayman and Associates (1996:33-44) and Harding (1986:432-667) have addressed this problem and found that girls are reluctant with regard to taking up Mathematics and Science, less motivated to do Mathematics and Science, lack the culture of science and rather shy away from Mathematics and Science. This is corroborated by the following findings of Dearman and Plisko (1981:19) and Hardin and Dede (1987:43-56): during high school years girls do not opt to take Mathematics and Science as much as boys do and girls do worse in Mathematics and Science than boys.

Socio-cultural influences and gender-role stereotyping with regard to participation in Mathematics and Science are well researched by Byrne (1993:376-380) and Kelly

(1988:151-163) but the focus is on a Western culture and not on an African culture. In addition, no explanation is given to what causes these behaviours especially in terms of the socio-cultural influences or traditions that girls experience. These are the shortcomings that this research will be addresses especially with regard to the situation in Namibia.

#### **2.1.4 Research findings regarding the situation in Africa**

Some researchers are of the opinion that gender stereotyping is more prevalent in Asia and Africa than in the United States and Europe (Lawrenz and Veach 2005:155). This is prevalent in Sub-Saharan Africa where culture and society have been influenced for centuries by a male dominated lifestyle in the field of Mathematics and Science (Lawrenz and Veach 2005:156).

Statistics suggest that in third world countries girls are less likely to attend school than boys (World Bank 1994:250). Although there has been a significant improvement in girls' access to schools, particularly at primary school level, in the past twenty years this has not been the case in Africa (Gilbert and Calvert 2003:861). By 1990 girls made up 47% of primary school learners, 33% of secondary school learners and 4% of tertiary students in Sub-Saharan Africa. This must be understood in the context of extreme poverty and socio-cultural aspects in which these girls live (World Bank 1994:234). Botswana and Namibia are the only two countries in Africa where there is a slightly higher enrolment rate for girls than boys (Block and Tabachnick 1998: 70-88).

Although Maccoby and Jacklin (1992:143) claim that boys and girls in general, especially in developed countries, enjoy Mathematics and Science at primary school level, this picture does not seems to apply to the African context as girls are less likely to take Mathematics and Science as their choice of subjects in Africa (Mwetulundila 1999: 36-37). This is corroborated by Klein (2004: 184) who argues that the inconsistency of results in Mathematics and Science between boys and girls is influenced by factors that have not yet been studied, like inter group ethnicity and socio-economics or socio-cultural differences manifested in various gender-related norms, stereotypes and expectations. This reiterates



the importance of socio-cultural influences when trying to understand gender stereotyping regarding participation in Mathematics and Science.

With the exception of a few schools in some African countries, the conditions remain the same in most schools (World Bank 1994:251), but the focus is now on how the socio-cultural factors will have an impact on the girls. According to Asmeng-Boahene (2006:87), many African countries face the problem of low levels of girls' attainment in Mathematics and Science. One of the causes thereof is that the goals, contents and methods of mathematics and science education are not supportive and or not sufficiently adapted to the cultures and needs of the African peoples. Although the participation in Mathematics and Science at primary level is compulsory in all Sub-Saharan Africa (UNESCO 2001:133), the gender gap becomes wider from senior secondary school to university level. This is mainly due to the fact that Mathematics and Science are no longer compulsory and most girls opt for other fields of studies. A study by Dovi (2004:1) reveals that it is mistakenly believed that girls in Africa struggle to achieve or pursue Mathematics and Science due to ability; it is rather the lack of opportunities that is a retarding factor. Girls at school can excel in Mathematics and Science if they have role models to follow, science club for girls, science competitions, funding and recognition awards on the school and national level (Dovi 2004:1). The school as an institution of change should have the culture that supports, promotes and enhances Mathematics and Science programmes.

The social and cultural perceptions regarding the expected roles of men and women in society are major impediments to the educational advancement of girls. According to Bloch and Tabachnick (1998:178), the main socio-cultural factors that affect women's participation and performance in education in Sub-Saharan Africa include family, religious, social and economic influences. The study further reveals evidence from Kenya that both male and female students from higher socio-economic backgrounds outperform lower-income students in all aspects of education, including Mathematics and Science. Bloch and Tabachnick (1998:179) claim that African families of lower socio-economic status will for moral or religious reasons rather send their sons than their daughters to college. Many

African families thus arrive at decisions that impede the education of their daughters. African men are less likely to marry women who are more educated than themselves especially in Mathematics and Science; therefore an educated daughter has less chance of having a husband, bearing children and maintaining her moral values (Bloch and Tabachnick 1998:179).

Another social problem in Africa is that of a high drop-out rate of girls due to pregnancy. Bloch and Tabachnick (1998:179) report that about 18 percent of African women aged between 15 and 19 give birth each year, as compared to 8 percent in Latin America and 3 percent in Asia in the same age group. In Botswana for example, 75 percent and 85 percent of dropout of girls from junior and senior secondary schools are due to early pregnancy (Bloch and Tabachnick 1998:179).

It is against the background of the above-mentioned statistics regarding the situation of girls in Africa that this study focuses on the underlying socio-cultural factors that cause girls in Namibia not to participate in Mathematics and Science.

### **2. 1. 5 Research findings regarding the situation in Namibia**

In the Namibian context, not much research has been done in this area. Very little research has been done with emphasis on gender equality and empowering girls through education in the field of Mathematics and Science. The high dropout rate and low enrolment of female students in Mathematics and Science was investigated by Tjipweja (2002:4-6), but with no particular reference to the cause of the problem. Mwetulundila (1999:23) also reports negative perceptions of girls about the Mathematics and Science fields in Namibia but no particular answer is given regarding the causes of the problem. Mwetulundila (1999:23) reports on the cause of female under representation in Mathematics and Science in Namibia, but the focus is on the colonial oppression and imbalances as the cause of the problem.

According to the 2001 population and housing census, there are more females in Namibia than males (Central Bureau of statistics 2003:33). According to the Journal of Educational Reform in Namibia (Tjipueja 2002:26), there are slightly more girls than boys in Namibian schools. This is also reflected by Kiangi and Tjiramba (2004:30) who note that “of the total number of graduating students, 66% (nearly two-thirds) were females”, which correctly reflects the overall gender ratio in the Namibian population. On the other hand, the enrolment at the University of Namibia in 2002 for the Bachelor of Science degree was 17 males and 8 females while the enrolment in 2003 was 21 males and 4 females. The trend continued for 2004 when 399 males and 259 females enrolled in the whole Science Faculty at the University of Namibia (Kiangi and Tjiramba 2004:13). According to the 2005 Annual Report, 43 males and 31 females graduated with Bachelor of Science degree (Kiangi and Tjiramba 2005:13).

These statistics serve as an indication that there are imbalances somewhere in the Namibian education system, which prevents girls to take part in the Mathematics and Science fields. Researchers in Namibia seem to focus on factors like the effect of colonial occupation, gender issues and how to reverse gender imbalances in the education sector. However, little is known about the effect of socio-cultural factors in this regard.

## **2.2 RESEARCH ABOUT GENERAL SOCIO-CULTURAL FACTORS**

In general it can be said that there are several factors that can influence the performance of a learner. This section endeavours to link some of the general socio-cultural aspects mentioned in the literature to the research questions mentioned in paragraph 1.4. In the sections below the information will thus be categorised according to the following broad socio-cultural factors that could influence the participation of girls in Mathematics and Science:

- positive or negative influences from parents and teachers;
- cultural or traditional inheritable norms;
- positive or negative beliefs and self-image;
- the attitudes of girls; and
- tinkering activities that girls are exposed to.

### **2.2.1 Positive or negative influences from parents and teachers**

An early study by Gibson (1980:88) suggested that a basic characteristic of an adolescent, namely the self-concept or self-esteem, is highly influenced by family, peer groups and educators. In this study, sub-question one investigates the positive or negative influences that girls may get from parents and teachers. The self-concept of an individual refers to the attitudes about one's self-worth, the individual's self-gestalt and the beliefs which an individual holds true about himself or herself. These beliefs stem from what parents or teachers say to their children or learners and could be influenced by differing expectations for male and female learners which are transmitted by parents, society and the schools (Wiest 2001:14). According to Safir (1986: 588), these beliefs lead to heavy cultural pressure for males to be more successful than females. This means parents rank intellectual and educational value lower for girls than for boys resulting in girls suffering from a negative self-concept (Labudde et al. 2000:145).

Labudde et al. (2000:143) have examined the different interactions that teachers have with male compared to female learners in science classes. This is mainly due to the fact that teachers have different expectations and beliefs about pre-existing knowledge in girls and

in boys. These beliefs turn to justify the teachers' rate of asking questions and giving more practical tasks to boys than girls in Mathematics and Science. Van Leuven (2004: 249) describes teachers as having expectations that girls are not as capable as boys in Mathematics and Science. The teachers' expectations influenced by culture can lead to self-fulfilling prophecies as far as female secondary school learners' achievement is concerned. Sub-question 1 aims to find out about the positive and negative influences that girls have that originate from parents and teachers. Parents and teachers are role models to girls (Mwamwenda 2005:49) and what they say or how they influence them is of great significance to this study. In light of the above-mentioned findings, sub-question 1 becomes essential in answering the main research question.

Another overriding influence from parents is that of socio-economic status that has always been seen to be a very important factor in the achievement of learners. Saha (1992:191) says that, "parents' socio-economic level is thought to exercise an independent positive effect in the male and female learners' science performance, but a negative effect on the career aspiration of a female adolescent learner." The socio-economic level of parents affect things like purchasing of science equipment, funding of project and other financial support needed by the school (Buseri 1987: 232). The study by Tait (1996: 749-751) suggests that parents with high education (and this is associated with high income) tend to have high aspirations for their children's education and this in turn motivates girls to aim high.

From the arguments above, it should be clear that it is imperative to ascertain what negative or positive influences from parents and teachers might contribute to girls' performance in Mathematics and Science.

### **2.2.2 Cultural or traditional inheritable norms**

There are beliefs and norms that stem from cultures and traditions that convey the negative message that girls are less capable in Mathematics and Science than boys. Sub-question 2

deals with these types of treatments from parents towards girls in terms of tradition and culture. Van Leuvan (2004:249) mentions numerous studies about similar issues:

- there are cultures that encourage the mathematics achievement of boys more than girls;
- there are traditions that have a more scientific career expectation of boys than of girls;
- some science teachers interact more with boys than with girls in class;
- girls are called on less frequently and receiving minimal feedback in science classes;
- elementary teachers expect girls to use set rules and algorithms to do mathematics but allow boys the independence to invent solutions;
- school counsellors not encouraging girls to enroll in advanced mathematics and science in upper grades, because they view these fields as too complicated or redundant for girls; and
- there are few female role models in the Mathematics and Science field that can encourage girls to take part.

Cultures and traditions are inheritable from parents (Mwamwenda 2005: 374-375), and it is the duty of parents to teach and educate their children about what is acceptable and what not. It is believed that if the cultures of child-rearing practices are gender-stereotyped, then boys and girls will be brought up very differently from each other (Van Leuvan 2004:249). This means that in most cases, parents will rather spend more money on boys than on girls; therefore girls are conditioned from an early age that they are inferior to boys (Dorsey 1989:2). This may negatively affect the motivations and achievements of girls.

The school should not become an extension of child rearing practices for girls by gender-stereotyping subjects (Flanagan 1993:363), but should rather encourage female learners to take up science subjects (Young and Fraser 1994:257). In some cultures, the school child-rearing practices are to be blamed for the girls' relatively low achievement. Boys are often thought to attain higher grades in physics than female learners because of the unequal science related experience and cultural stereotyping of the female role combined with a non-science career orientation. If the schools' cultures and traditions support and encourage

girls to do Mathematics and Science, they will have high interest in these fields (Byrne 1993:376-380; Kelly 1988:151-163 and Lawrenz and Veach 2005:156).

Sub-question 2 focuses on the study of cultural and traditional inheritable norms of child-rearing practice both at school and at home. Wiest (2001:14) argues that gender differences in Mathematics and Science performance are predominantly due to the accumulated effect of gender-role stereotypes in the family, culture and traditions. This means that when girls have to choose a career they have to consider what vocational choices are acceptable in the community for a girl to follow before making a choice. Sub-question 2 aims to explain the issue of the influence of culture and tradition by examining the level of freedom and influences girls have in pursuing careers in the fields of Mathematics and Science.

### **2.2.3 Positive or negative beliefs and self-image**

Beliefs may stem from a variety of influences such as parents, religion and tradition and is not static, which means it can change with time. The environment can affect one's beliefs (O'Connell 1994: 83). As Seifert (2004: 139) says, "self-efficacy is the person's belief that he/she is able or unable to perform the task at hand and is correlated with achievement-related behaviours like motivation and self-worth." Van Leuvan (2004: 248-249) says that "women constitute only a small percentage of the Mathematics and Science workforce because of their beliefs and attitudes that contribute to their Mathematics and Science interest and experience." If these beliefs are negative, it will cause girls to often underestimate their Mathematics and Science competence, feel less adequate, and have lower expectations for success in Mathematics and Science compared to boys (Van Leuvan 2004:249). To answer the research question of this study, it becomes imperative to understand the beliefs (sub-question 3) that girls hold true about themselves, and about Mathematics and Science.

#### **2.2.4 The attitudes of girls**

Most young women do not see themselves as being capable of studying and succeeding in Mathematics and Science, therefore they are not interested in it (Gilbert and Calvert 2003: 863). The myths and realities of women progressing in the Mathematic and Science field were studied by David et al. (1996:29-95) who concluded that “the attitudes adopted by girls from parents, teachers, friends and society have a significant influence on the girls’ choices and performance in Science and Mathematics.” These influences come from a cultural or social background and that is what sub-question 4 investigates.

The school should provide equal opportunities for both boys and girls, but, as Labudde et al. (2000: 143) report that “most boys have more positive attitudes fuelled by higher achievement in physics and mathematics, while girls are slightly more confident about attaining language proficiency.” The same study suggests that girls can do well if they are assisted through building positive attitudes and aspirations. Even though there is a tendency among low social economic status schools to practice gender chauvinism against female learners (Smith, Cowie and Blades 1998: 501), it is believed that when the school environment is enriching and it stimulates positive attitudes, female learners will achieve higher grades (Wiest 2001: 14). Schools with less provisions, fewer teachers, poor school buildings and inadequate facilities for female learners will have a negative influence on the attitudes and academic achievements of female learners (Jules and Kutnick 1990: 232-233). Sub-question 4 aims to bring to light the type of attitudes that these girls have towards Mathematics and Science.

#### **2.2.5 Tinkering activities that girls are exposed to**

Tinkering activities refer to the activities that children fiddle or experiment with during their play in their early childhood. These activities involve handling toys, tools, dismantling and fixing cars and learning motor skills like riding a bicycle or fixing it. As a result of these engagements in variety of physical activities with various toys, the child’s motor skills are facilitated and consolidated (Mwammwenda 2005:48). Van Leuvan (2004: 250) states that parents’ interaction and expectations may promote sex-role stereotype by encouraging boys



to explore, take risk, and develop independence, whereas girls are expected to engage in safe, stationary plays. He further suggests that Science and Mathematics games and toys that develop spatial reasoning and thinking skills are given more to boys than girls.

The support, influence and game activities with friends, family and peers are factors that foster gender-equitable perceptions, higher academic achievement and better self-concept in girls (Klein 2004:184). A study by Labudde et al. (2000:143-144) reveals that there should be a strong bond between physics contents and students' every day experiences. This implies that students who are exposed to technological toys and games (which in most cases are boys) will have greater interest in Mathematics and Science because of the pre-existing knowledge that they have. This knowledge plays an important role in the understanding of Mathematics and Science rather than the gender differences (Lubudde et al. 2000:150). Parent-child interaction and expectations mostly favour boys in that they are more frequently exposed to Mathematics and Science related toys and games that develop spatial reasoning and thinking skills than girls are (Gilbert and Calvert 2003:879). These characteristics stem from early childhood like exposure to computer games, cell phones and other traditional games that involve counting (Van Leuvan 2004: 249 and Roychoudhury, Tippins and Nichols, 1995:897-924). Sub-question 5 addresses how girls' performance in Mathematics and Science is affected or influence by the tinkering activities they engage in.

### **2.3 CLARIFICATIONS OF TERMS**

It is important to define terms that could be misinterpreted in order to establish a frame of reference in which the researcher approached the problem (Best and Kahn 1993:40). For terms and concepts to carry any meaning that pertains to the study, they need to be defined in a clear, non-ambiguous and understandable way, which is done by defining terms and concepts either in a conceptual or operational manner.

**Science:** *It is the organised knowledge based on observation and testing of fact about the physical world, natural laws and society. In this study it refers to the knowledge of the following disciplines; Physical Science, Life Science, Geology, Biology and Natural Science.*

**Under-representation of woman:** *Fewer women in different sectors of society compared to men e.g. legislators, parliamentarians, in labour sectors be it private or state owned.*

**Affirmative action:** *The Namibian government's initiative in addressing the past colonial imbalance in areas like job acquisition, land acquisition and in educational opportunities, by giving privileges to qualified former disadvantaged Namibians in order to enhance the balance between the rich and poor.*

**Gender equality:** *A 50/50 representation of men and women in all sectors of society.*

**Negative perceptions:** *The bad intuition, gaining of knowledge or awareness of the external world, or some aspect of it through physical sensations and the interpretations of these by the mind.*

**Socio-cultural beliefs:** *The mental conditions or habits stemming from the living conditions, arts, behaviour and artistic expression in the community or society.*

**Girl:** *In the context of this study, it refers to a female learner between the ages 11 and 18.*

**Social:** *Relations between people or communities.*

**Culture:** *Culture can refer to the customs or artistic achievement of a particular community or people in social, moral, historical laws, and developmental stages. Culture is equivalent to the intellectual side of civilisation and it stems from training, development and refining of mind from a young age by elders in the norms that are regarded as acceptable by that social group, institution or community.*

**Factor:** *The Reader's Digest Universal Dictionary (1988:548) gives the meaning of factor as an element that actively contributes to an accomplishment, result, or process, a cause. Vos and Brits (1990:39) summaries cultural factors as to cover issues like the logical (analytical thinking), historical, lingual, social patterns, economic, aesthetics, juridical, ethic and the like.*

**Namibia:** *Namibia is a sovereign state in the Southern African Development Community (SADC) that gained independence from South Africa in 1990 after 300 years of colonial rule and oppression. The population is about 2 million of which 64, 2 % are females. It has a relatively low literacy and a high unemployment rate despite its low population, and the government emphasises the strategic importance of education in the socio-economic development of the country*

**Self-efficacy:** *Self-efficacy refers to the belief of the person that he or she is able/ unable to perform a task at hand and is correlated with achievement-related behaviours, self-worth, achievement-performance, motivation, positive processing and the like.*

**Influence:** *The ability to affect, persuade a person or a course of events indirectly or intangibly in a way that ones desire. This affect is mostly based on prestige, wealth, ability, character, or position.*

**Attitudes:** *An attitude can be understood as an emotion that has an influence on the behaviour of human beings. Le Roux (1994:06) define attitudes as “positive or negative emotional relationship with or predisposition towards an object, institution or person.”*

**Mathematics:** *The science of numbers, quantity and space of which for example arithmetic, algebra, trigonometry and geometry are branches.*

**Attribution theory:** *The perceived cause of an outcome; why did a particular event turn out to be like this? For example, “I fail Mathematics tests because I’ m a girl.”*

**Self-worth theory:** *The motivation of students as to the level of acceptance or capability in doing certain tasks successful in the communities, for example, it is not culturally accepted in certain communities for a woman to do engineering work.*

**Self-motivation:** *The motivation that come from within an individual about his/her abilities to perform a task, for example, a girl saying ‘I can solve that equation’ and readily attack the task at hand, or when we witness a girl proclaiming, ‘ I can’t do that’ and fails even to attempt the task.*

**Achievement goal theory:** *It is the attempt to achieve goals, it refers to students’ desire to achieve a particular goal, for example, positive self-regulating and self-determining factors of a girl can produce positive internal and controllable factors.*

**Self-efficacy theory:** *Confidence. It refers to a person judgment about his/her capability to perform a task at a specific lever of performance for example girl’s belief about solving or not solving a Mathematics problem. Students who believe in themselves to be capable are more likely to be motivated in doing a difficult task.*

## **2.4 CONCLUSION**

This chapter has provided a summary of studies in Mathematics and Science in relationship with the topic under investigation. From the literature it becomes evident that various experiences that girls go through contribute heavily to their perception, beliefs and interest in Mathematics and Science. Parents and teachers can influence girls both positively and negatively. There are other influences that originate from culture and traditions that contribute to the girls' choice of subjects. It is also evident that girls should be exposed at an early age to counting games so that they can develop spatial reasoning just as boys. Generally, some socio-cultural factors like, self-concept, school environment, teacher expectations, beliefs, child rearing practices and societal educational aspirations are factors that contribute to the girls' career choice. The next chapter presents the research methodology of the study.

# CHAPTER 3

## RESEARCH METHODOLOGY

### 3.1. INTRODUCTION

This chapter briefly presents an overview of the research design employed, the subjects, the data collection procedure, the instrument used, the data analysis and the limitations of the research design. The term “method” is derived from the Greek word “methodos” which means “the road by which” (Venter and Van Heerden 1989:108). The road by which this stage in this study was reached started out with a number of research questions and a literature study in this regard. This is followed by the identification of a number of theoretical constructs in the literature in order to link the research questions and the method of data collection.

Creswell (2003:120) defines a theory as “a set of interrelated constructs (variables), definitions, and propositions that presents a systematic view of phenomena by specifying relations among variables, with the purpose of explaining natural phenomena.” This interrelated set of constructs helps in explaining or predicting phenomena that occur in the world. From the literature review in the previous chapter, the following theoretical constructs were identified to serve as the frameworks on which the data collection was based:

- **Construct 1:** If the influences of parents and teachers are favourable to Mathematics and Science, then girls will have positive attitudes towards these subjects (Brophy 1985:115-142; Eccles and Jacobs 1986:367-380).
- **Construct 2:** If the culture and traditions of girls support and encourage them to do Mathematics and Science, they will exhibit a high interest in these fields of study (Byrne 1993:376-380; Kelly 1988:151-163; Lawrenz and Veach 2005:156).
- **Construct 3:** If the beliefs and self-image of girls are positive towards Mathematics and Science, their self-esteem will foster self-confidence and the ability to excel in these subjects (Hanson 1996:56; Kahle, Parker, Rennie and Riley 1993: 379-404; Mayer and Khoehler 1990:60-95).

- **Construct 4:** If the attitudes of girls are positive towards Mathematics and Science, they will also show a positive interest in the subjects. If there are equal opportunities for both boys and girls in these subjects, girls will be much more motivated to pursue and excel in these subjects (Hanson 1996:56).
- **Construct 5:** If girls were exposed at an early age to Mathematics and Science related activities such as counting games and simple experiments, they will learn to love these subjects. For instance, Mathematics and Science games and toys that develop spatial reasoning and thinking skills should also be provided to girls (Van Leuvan 2004: 249; Sjoberg and Imsen 1988:218-248; Roychoudhury, Tippins and Nichols, 1995:897-924).

### **3.2 DATA COLLECTION PROCEDURE AND INSTRUMENT**

According to Bogdan and Biklen (1992:106), data refer to the rough materials researchers collect from the world they are studying. There are various methods and techniques of data collection. The researcher should choose the best techniques which will elicit the data needed to gain an understanding of the phenomenon in question, contribute to different perspectives on the issue and make sufficient time available for data collection (Glesne and Peshkin 1992:24). This study used the closed question questionnaire to collect data.

#### **3.2.1 Questionnaire**

One of the most compelling reasons for choosing a questionnaire for this study is the advantage that it has regarding the possibility of obtaining information from a large and geographically widespread sample without the direct presence of the researcher. According to Johnson and Christensen (2000: 127), a questionnaire is a self-report data-collection instrument which each research participant fills in as part of a research study. They maintain that researchers use questionnaires so that they can obtain information about the thoughts, feelings, perceptions, attitudes, beliefs, values, personality and behavioural intention of the participants. In this study the questionnaire is designed to examine the following three components of attitudes that girls have towards Mathematics and Science:

- an affective component, which consists of the individual's feelings about Mathematics and Science;
- a cognitive component, which is the individual's beliefs or knowledge about Mathematics and Science; and
- a behavioural component, which is the individual's predisposition of acting towards Mathematics and Science in a particular way (Borg and Gall 1989:311).

Davies (2007:94) highlights the importance of the words and concepts used in the questionnaire as they could have different meanings to different respondents. To minimize this effect an information sheet was provided to the teachers who handled the questionnaire. This ensured that the specific words and concepts in the questionnaire meant the same to primary school girls as well as to secondary school girls. Due to the fact that the questionnaire is anonymous, an identification number was provided on each questionnaire in order to keep record.

A closed-question questionnaire was chosen because it:

- contains questions or statements requiring short, concise answers and the respondent chooses his/her answer from a number of alternatives. In other words, the respondents are limited to a few alternative questions that are easy to respond to;
- does not take too much time to answer;
- is relatively objective, focuses the respondent on the subject to be studied; and
- is easy to tabulate and easy to analyze and less open to misinterpretations (Gay 1987: 195; McMillan and Schumacher 2001:261).

However, Kothari (2001:125) has identified the following criticisms regarding closed-question questionnaires:

- they do not provide any opportunity for the respondents to explain their answers;
- they limit the respondents to the statements and questions provided; and
- the researcher may not provide all the necessary alternatives and may force respondents to respond to issues that they may not understand or have an opinion on.

It is thus the responsibility of the compiler of the questionnaire to use closed questions that are well-thought out and relevant to the problem at hand (McMillan and Schumacher 2001:259).

In order to accomplish the objectives stated in Section 1.3.1, questions relating to the following issues were used: self image, tinkering activities, male domain, beliefs, culture and tradition, teacher's and parent's role. A Likert-type ranking scale on a five point continuum was used and the respondents thus have to indicate, on a five point scale to what extent they agree or disagree with a statement by marking the appropriate box for the particular statement. Half of the questions were stated positively/favourably and half of the statements are stated negatively/non-favourably. Having 50% favourable statements and 50% non-favourable statements was done with the aim of striking a balance between the positive and negative statements. If participants are to answer only positively stated questions or only negatively stated questions, it could become monotonous and people might mindlessly agree with all statements and thus dilute the credibility of the instrument.

On the next page in Table 3.1 the variables that are observed in the questionnaire are shown together with the statement number. They are: self-image and belief; teacher and parental role; culture and traditions; tinkering activities; male domain and girls attitudes. The table also shows the positively and negatively stated statements and the pattern of scoring.

### **3.3 A PILOT STUDY**

To increase validity of the study, the questionnaire was first piloted to determine whether it elicited the intended responses and based on the responses and it was amended accordingly. Hollway and Jefferson (2007:8) observe that “the assumption in questionnaires and interviews that if words used are the same, and if they are communicated in the same manner, they will mean the same thing to numerous people in the sample,” was considered. The researcher was precise when formulating questions and adapting the questionnaire according to the results of the pilot study. Validity refers to the extent to which inferences made on the basis of numerical scores are appropriate, meaningful, and useful to the sample



(McMillan and Schumacher 2001:239). For instance, to enhance triangulation, relevant data sources were used to corroborate data and to find irregularities in the data, results from different samples were compared to see whether there were any recurring patterns.

The table below shows the observed variables, type of questions and the patterns of expected scoring in the questionnaire.

**Table 3.1**  
**Variables, types of questions and patterns of scoring**

Observed variable	Statement type and Number	Patterns of scoring				
		SA	A	UN	DA	SDA
<i>Teachers' and parents' role</i>	Positively stated 2,3,7,10	5	4	3	2	1
	Negatively stated 1,4,5,6,8,9	1	2	3	4	5
<i>Culture and traditions</i>	Positively stated 11,13,14,18,20	5	4	3	2	1
	Negatively stated 12,15,16,17,19	1	2	3	4	5
<i>Beliefs and Self- image</i>	Positively stated 21,24,26,27,30	5	4	3	2	1
	Negatively stated 22,23,25,28,29	1	2	3	4	5
<i>Male domain and girls' attitudes</i>	Positively stated 32,35,37,38,39	5	4	3	2	1
	Negatively stated 31,33,34,36,40	1	2	3	4	5
<i>Tinkering activities</i>	Positively stated 41,44,45,46,47,50	5	4	3	2	1
	Negatively stated 42,43,48,49	1	2	3	4	5

SA=Strongly Agree; A=Agree; UN=Undecided; DA= Disagree SDA= Strongly Disagree

According to Burns and Grove (2003:42), a pilot study is often described as "... a smaller version of the proposed study, and is conducted to refine the methodology." A pilot study helps to identify possible problems in the proposed study and allows the researcher to

revise the method and the instrument before the actual study is conducted (De Vos, Strydom, Fouche and Deport, 2005: 206).

A pilot study was conducted at a school that is not included in the final study to smoothen out any difficulties that the girls may encounter when completing the questionnaire. The girls in the pilot study were from the same age group as the ones in the final sample in order to determine to what extent they understood the questions and to decide whether some of the questions should be reformulated or not. The researcher was able to assess the time they took to complete the questionnaire and other difficulties such as language, meaning and choices they had to make (Thomas 2003:68). The pilot study was completed by 10 girls who were then interviewed by the researcher after completing the questionnaire. The girls in the pilot group, for instance, asked for the explanation of the following items at the interview after the pilot study: (number 6) the word; self-esteem (*Think of with respect*) and (number 15) the word; minority (*regarded as smaller or less valuable than . . .*).

### **3.4 RESEARCH DESIGN**

A research design should describe the procedure for conducting the research. It should indicate how the research is set up, what happens to the subjects and what methods of data collection are used (McMillan and Schumacher 2001: 31). Due to the nature of the problem under discussion, a quantitative non-experimental mode of inquiry or survey was chosen. A survey describes records, analyses and interprets conditions that either existed or still exist. McMillan and Schumacher (2001: 34) describe a survey as involving the frequency of demographic characteristics or trials held, exploring relationships between different factors and describing the reasons for a particular practice. Surveys are good for exploring different factors, attitudes and/or relationships by inferring information for a large number of subjects (the population) from the responses obtained from a smaller group of subjects (the sample). The information collected by a survey instrument such as a questionnaire is assumed to be quantifiable, and it can be analysed and reported quantitatively (McMillan and Schumacher 2001: 304). This study investigated the responses of selected samples of subjects by administering a questionnaire.

### **3.5 SAMPLE**

The target population from where the sample was selected was primary and secondary school girls aged between 11 and 18. These girls were the focus of the study and they were still in their formal operational stage, where they had to make some major decisions like career choices derived from the influences in their life (Mwamwenda 1995: 97). Hall's study (in Hurlock 1992:221) suggests that cultural influences play a major role in maturation factors that characterise the behaviours in the adolescent. Normally adolescence involves children whose ages are between 12-21 years old (Mwamwenda 1995:63).

Dauson (2007:54) and Thomas (2003:91) suggest that "the sample should be manageable," on the other hand, the larger the sample, the more trust we can put on the notion that the sample does, indeed, accurately reflect the pattern and characteristics of the population. This study took into account these factors including non-response by choosing a higher proportion of sample. With this in mind, the schools were selected randomly by putting the names of the schools in a container and randomly selecting 9 schools out of 19 in the Khomas region and 5 schools out of 11 in the Hardap region. This type of selection also enhances other social, psychological and economical factors that might be of influence to the perceptions of girls towards Mathematics and Science because every learner in the different groups had an equal opportunity to be selected for the sample.

With the help of educators in the particular schools and the records they keep, girls were selected using a stratified random sampling by first dividing girls according to the following sub-groups (age and level of education): 13 years, Grade 7, 14-15 years, Grade 8-9 and 16-18 years Grade 10-12. From these three groups, samples were drawn randomly by putting the learners' names in a container and randomly selecting equal numbers of learners from each group to result in a proportional sampling consisting of equal numbers. The sample sizes added up to a total of 1680 girls from primary and secondary schools from the two regions. In the Khomas region 9 schools with a total of 1080 girls were selected, while in the Hardap region, 5 schools with a total of 600 girls were selected.

### **3.6 INDUCTIVE DATA ANALYSIS**

According to Bogdan and Biklen (1992:153), data analysis is “the process of systematically searching and arranging the data transcripts, field notes and other materials which were accumulated by the researcher to increase his or her understanding, which enable the researcher to present that which was discovered.” According to Johnson and Christensen (2000: 317), “data analysis involves coding, categorising and clustering information.” The objective of this section is to indicate how the data were analysed, for example, which statistical procedures were used. The Chi-squared statistical technique was used to test significant differences between diverse frequencies.

The validity was enhanced by the fact that the sample was drawn from so many different schools and different language backgrounds of girls in Namibia. To ensure reliability, the researcher used a consistent data gathering procedure for all of questionnaires. To enhance triangulation, the researcher did interim data analysis and corroboration to ensure matching between findings from questionnaires. The different results from questionnaires were compared in terms of region and grade to get a clear picture of the behaviours of these girls at different levels.

### **3.7 LIMITATIONS OF DESIGN**

#### **3. 7. 1 Scope limitations**

Although Namibia has 13 regions and over 500 schools, due to time and financial constraints, the research focused only on the few identified schools in two regions.

#### **3. 7. 2 Methodological limitations**

The researcher’s role could have been limited in terms of language in remote rural areas and possibly by some other unknown cultural influences in the field. One of the noticeable language limitations was at the primary schools in rural areas, where learners experienced a few problems with the questionnaire. The pilot study was conducted at a school in an urban area. The learners found some English terms difficult to understand because they used

Afrikaans most of the time. The researcher, being a man investigating on sensitive female issues, could perhaps have invoked some of the constraints mentioned by Mwetulundila (2000: 26) such as stereo-type attitudes and beliefs that girls do not talk to a man in certain ways and the invisible gender imbalance of text books as well as classroom dynamics. Some other limitations are inherent to quantitative methods such as that the use of questionnaires usually produce a low response rate or that the return rate could be affected by the length and type of questions asked (Wisker 2001: 142).

The learners' parents were asked for permission by means of a letter which they were required to sign and return (see Appendix F). Some parents and learners were reluctant to sign and return the letter. Some of the reasons sighted were that the parents are not in town, lack of interest or that the letter got lost. Other limitations inherent to quantitative studies are: the survey instrument (questionnaire) may not portray an individual girl's life conditions as those conditions that affect the girl's interest in Mathematics and Science. In short, quantitative surveys fail to describe the qualitative features that make for the uniqueness of each member of the collectiveness that the survey is intended to represent (Thomas 2003:44).

### **3.7.3 Design limitations**

Mwetulundila (2000:26) mentions that cultural experiences coupled with what girls perceive to be happening around them could influence their subsequent behaviour. This might have affected the way the girls answered the questionnaires. Other limitations inherent to the use of quantitative methods, particularly closed-question questionnaires, is that there is less scope for the respondents to provide answers which reflect the exact facts or their true feelings. As Denscombe (2007:166) states "the respondent might get frustrated by not being allowed to express their views fully in a way that accounts for any sophistication, intricacy or even inconsistencies in their views." The extrapolation of the findings should thus be addressed and analysed with an open perspective in mind.

### **3.7.4 Literature review limitations**

Some limitations were encountered during the literature review; limited research has been done in Namibia in these areas with little focus on the influence of culture, tradition and beliefs regarding the participation of girls in Mathematics and Science. The lack of related relevant information therefore limited the researcher in determining how the present findings would be explained beyond previous work or how they would test or extend theory from previous work (Punch 2006:39) in the Namibian context. The researcher relied mostly on studies from other countries which might not have relevance to the Namibian situation.

### **3.7.5 Empirical limitations**

The sample size was relatively small, which implies that these findings cannot be generalised to all Namibian girls.

## **3.8 ETHICAL ISSUES**

A number of ethical issues were considered in this study; for example, participants were not forced to complete the questionnaire or to take part in the interview, it was a voluntary exercise; anonymity was ensured by not collecting their names; permission was requested from the educational authority, parents and school leadership (see Appendix D-F); and participants were well informed about the purpose of the study. Those that accepted to complete the questionnaire were allowed to do so at their own time and convenience, although not all returned the questionnaires.

## **3.9 CONCLUSIONS**

This chapter focused on the five constructs from literature on which the research questions are based. It further described the data collection procedure and instrument followed by a description of the pilot study, research design and limitations of design. The next chapter presents the analyses of collected information starting with the role of the researcher as well as a brief introduction of the regions visited. The questionnaire is presented and discussed with the summary of the different results from participants.

# **CHAPTER 4**

## **DATA ANALYSIS**

### **4.1 COLLECTED INFORMATION CONVEYED**

#### **4.1.1 Introduction**

In this chapter the data emanating from the questionnaires are presented. As mentioned in the previous chapter, the questions are categorised according to the issues in the following order (with 10 questions relating to each issue) and named as indicated: Influence from teachers and parents, Culture and traditions, Beliefs and self image of girls, Male domain and girls' attitudes, and Tinkering activities. The data analysis is presented in five sections according to these categories. The information from the whole questionnaire is presented in Appendix A.

The different schools from which data were gathered are briefly introduced to give a clear background. Due to the fact that the researcher assured participating schools as well as participants of confidentiality and anonymity, the names of the schools and participants are not mentioned.

#### **4.1.2 The role of the researcher**

The personal relationship that the researcher builds with the subjects and the role that the researcher adopts in relation to the study could influence the results obtained (Thomas 2003:75). According to Hoberg (1999:25) and Ary (1990:447), the researcher is an integral part of the data gathering instrument and much depends on what he/she sees, hears, observes and analyses. This is why Patton (1990:14) refers to the validity and quality of a study as something that depends to a great extent on the skills, competence and rigor of the person doing the study. According to Hollway & Jefferson (2007:3), the power that researchers have about modifying, selecting and interpreting what the participants tell them should be kept in check by being faithful to the voices of those they are researching.

The main role of the researcher in this study is to rigorously collect and faithfully analyse the collected data. It is also the responsibility of the researcher to protect the anonymity of participants and to guarantee confidentiality from the onset of the study. The participants were assured that data would be used for research purposes only with the view to better the lives of women and improve their participation in Science and Mathematics.

## **4.2 THE CONTEXT OF THE TYPE OF SCHOOLS VISITED**

### **4.2.1 Hardap Region and the schools visited**

The Hardap region is the second largest region in Namibia after the Karas region. It is situated in the south central part of the Republic of Namibia. The majority of the people are making a living from small stock farming and agricultural production. Glen and Peshkin (1992:24) maintain that the researcher should select a site where he or she would be accepted and feel comfortable working. The Hardap region was selected because it is well known by the researcher and it is populated by different ethnic groups.

Five schools were selected in the Hardap region. Two of them are a few kilometres from the town Mariental and the other three are situated within the town of Mariental itself. The buildings of the two schools outside the town are in a good condition and on average each class accommodates 30 learners. The schools in town have well established buildings, electricity, running water, good sanitation and modern library facilities equipped with computers and internet. The schools in the city are slightly overcrowded with a teacher-learner-ratio of 1:38. The learners in these schools are generally of mixed ethnic groups with learners from different economic and cultural backgrounds. Discipline seems to be a problem in these three city schools; the researcher witnessed several incidents of disrespect towards authorities, fighting and teasing among learners. The way they wear their uniform is awkward. Girls' skirts are too short and most boys wear shirts out of their pants. Academically, the three schools are regarded as average performers.



#### **4.2.2 Khomas Region and the schools visited**

The Khomas region is situated in the centre of the Republic of Namibia and is considered the backbone of the economy of the country. Geographically, it is the second smallest region, but the most densely populated in the country. The capital city Windhoek is home to about 388 000 people and is the most industrialised town in Namibia.

Four primary schools and five secondary schools were selected. They range from well-off schools to meagrely financed schools due to their geographical location in the town. They have well established buildings, running water, electricity and good sanitation with up to date laboratories and internet connections. The learners in these schools are generally of mixed ethnic groups with an average learner/teacher ratio of 1: 35. Learners in these schools are generally well disciplined and always wear school uniform. Academically, these schools are regarded as average to above average performers. The researcher is a teacher in one of the selected schools.

### **4.3 QUESTIONNAIRE**

#### **4.3.1 Introduction**

The researcher sought permission to administer the research questionnaire from the principals of the nine schools. The purpose and ethics of the research were also explained to educators and learners prior to the commencement of the research process.

The questionnaire consists of 50 statements of which 25 are positively stated and 25 are negatively stated as previously explained. The split-half method, with each half of similar difficulty (50% of the statements favourable and 50% unfavourable), is used to enhance internal consistency. During the pilot study, it was found that the scores recorded for the two halves were similar, indicating a high degree of correlation and reliability (McMillan and Schumacher 2001: 246). According to Denscombe (2007: 296), reliability “refers to whether a research instrument is neutral in its effect and consistency across multiple occasions of its use.”

The questionnaire was distributed to nine schools in the Khomas region and five schools in the Hardap region. Of the total of 1680 questionnaires that were distributed, only 1442 (85.83%) were returned. From the nine schools in the Khomas region, a total of 966 out of 1080 (89%) questionnaires were returned, and 476 out of 600 (79.33%) were returned from the Hardap region.

#### 4.3.2 Presentation of questionnaire results

The table below shows the age range of participants, their frequency and percentages.

**Table 4.1 Frequency and Percentage of different age groups.**

AGE GROUP	FREQUENCY	PERCENTAGE
Less than 14	303	21
14-15	360	25
16-18	779	54
<b>Totals</b>	<b>1442</b>	<b>100</b>

##### 4.3.2.1 Learners per school

Table 4.2 below shows the number of learners per school who answered the questionnaires. Due to the anonymity agreement between the researcher and the different schools, alphabetic letters are used instead of the schools' names. Regions, primary schools, secondary schools and totals are reflected in the table.

**Table 4.2 Learners per school**

<b>Khomas Region</b>		<b>Hardap Region</b>	
Primary schools	Secondary schools	Primary schools	Secondary schools
A=68	E=138	A=26	C=88
B=71	F=137	B=22	D=80
C=81	G=149		E=103
D=92	H=178		
	I=209		
312	811	48	271
Total (Khomas)	1123	Total (Hardap)	319
Total for all schools 1442			

Tables 4.3, 4.5, 4.7, 4.9 and 4.11 below present the results corresponding to the research sub-questions 1.4.1.1 to 1.4.1.5 as stated in Chapter 1. To enhance the presentation of the results for each set of ten statements of each research question, a bar-chart was used to depict the results (Bar-chart 4.1 to 4.5). This is supported by Davies (2007:221) who maintains that the best form of presenting data recorded according to a Likert-scale is in the form of bar-charts.

The bar-chart is followed by Tables 4.4, 4.6, 4.8, 4.10 and 4.12 for each set of ten statements depicting the relevant Chi-squared values and the level of significance for each item. For the Chi-squared value with one degree of freedom to be statistically significant at the two tailed 0.05 level, it has to be 3.84 or bigger (Cramer 1997: 118). The results for each set of ten statements were then discussed with the aim to determine whether the frequencies of girls agreeing with particular statements differed significantly from the frequencies of girls disagreeing with those statements.

### **4.3.3 Influence from teachers and parents**

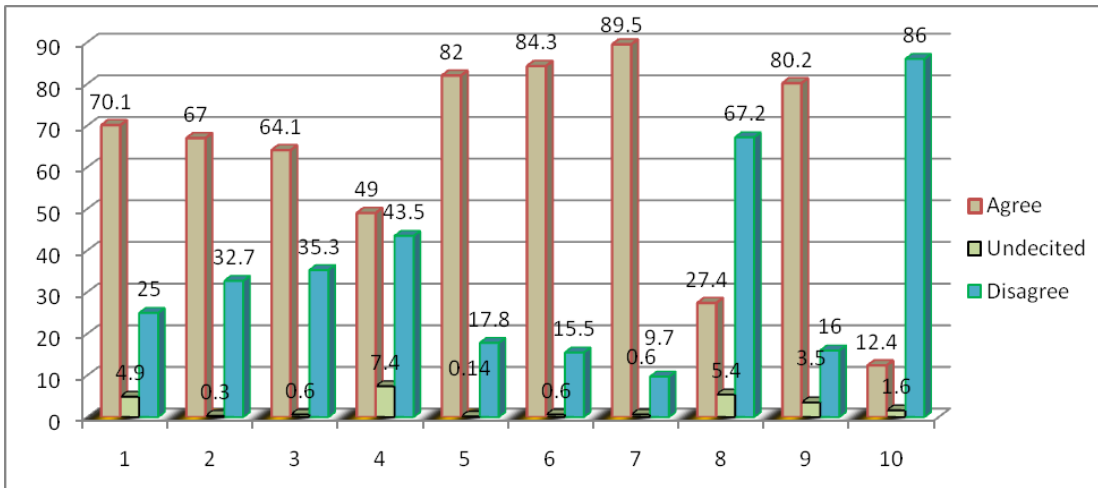
The table below shows responses for the ten statements of sub-question 1.4.1.1. *What positive or negative influences do girls have about Mathematics and Science from parents and teachers?* The result is tabulated as frequencies for Strongly Agree, Agree, Undecided, Disagree and Strongly Disagree, with the corresponding percentages in brackets.

**Table 4.3 Results for statements 1 to 10**

Statement. No	Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree	Non-response
1) The Science teacher often asks boys questions rather than girls.						
	531 (36,8)	480 (33,3)	70 (4,9)	131 (9)	230 (16)	1 (0,07)
2) I am <b>free to express</b> my opinion in the Physical Science class.						
	743 (52)	220 (15)	5 (0,3)	217 (15)	256 (17,7)	1 (0,07)
3) In my school boys and girls learn Mathematics <b>equally</b> .						
	650 (45)	280 (19,1)	10 (0,6)	298 (21)	208 (14,3)	0 (0,0)
4) My parents <b>discourage</b> me to take Mathematics as my major in the future.						
	490 (34)	218 (15)	107 (7,4)	450 (31,2)	177 (12,3)	0 (0,0)
5) Boys <b>discouraged</b> girls during Science practical work.						
	702 (48,7)	480 (33,3)	2 (0,14)	24 (16,6)	17 (1,2)	1 (0,07)
6) My Mathematics teacher <b>punishes</b> us for not knowing the correct answer.						
	918 (63,7)	298 (20,6)	1 (0,2)	102 (7)	123 (8,5)	0 (0,0)
7) My Science teacher <b>helps each individual</b> learner with Science problems.						
	750 (52)	540 (37,5)	9 (0,6)	100 (6,9)	41 (2,8)	2 (0,14)
8) From primary school years I was <b>discouraged</b> by teachers to do Science.						
	201 (14)	193 (13,4)	78 (5,4)	431 (30)	539 (37,2)	0 (0,0)
9) My parents <b>advise</b> me to take commercial subjects rather than Science.						
	663 (46)	497 (34,5)	51 (3,5)	108 (7,5)	123 (8,5)	0 (0,0)
10) I <b>get support</b> from my parents on Mathematics problems that prove difficult.						
	93 (6,6)	84 (5,8)	21 (1,6)	766 (53)	478 (33)	0 (0,0)

In the bar-chart below the results for statements 1 to 10 are depicted by combining the following three sets of results: a) strongly agree with agree, b) undecided and c) strongly disagree with disagree.

**Chart 4.1 Bar-chart for statements 1 to 10**



**Table 4.4 Chi-squared values for statements 1 to 10.**

Statement	1	2	3	4	5	6	7	8	9	10
Chi-squared value	16	11.7	8.2	0.82	41	47	47	15	42	59
Level of significance	>0.001	>0.001	>0.01	>0.5	>0.001	>0.001	>0.001	>0.001	>0.001	>0.001

In this Chi-squared calculation the data are arranged in two categories, such as agree and disagree. All the strongly agree and agree are grouped together to form one category and all the strongly disagree and disagree are grouped together. The total frequency observed in each category is then compared to the expected frequency. In this case it is assumed that half of the respondents would agree and half would disagree. For the Chi-squared value with one degree of freedom to be statistically significant at the two tailed 0.05 level of significance, it has to be 3.84 or bigger (Cramer 1997: 118), any Chi-squared value less than 3.84 will result in a lower level of significance.

Since Chi-squared values for statement 1, 2, 3, 5, 6, 7, 8, 9 and 10 are greater than 3.84 it can be deduced that there is a significant difference between the numbers of respondents who agree or disagree compared to the expected responses. This implies that more respondents are in favour of agree or disagree, depending on the type of statement (positive or negative) than the expected split half. Statement 4 shows a lower level of significance between the respondents that agree and disagree. This implies that for statement 4, there is a split in half of parents who encourage and discourage their children to take Mathematics as their major in future. It can therefore not be concluded for statement 4, that the majority of the parents discourage their children to take Mathematics in their future.

#### **4.3.3.1 Presentation of results for Table 4.3**

The results for statement 1 indicate that 36, 8 % and 33, 3 % of respondents strongly agree or agree respectively with the statement: *The Science teacher often asks boys questions rather than girls*. This indicates that 70, 1 % of the girls hold the view that their teachers treat girls differently from boys. However, 25% (disagree and strongly disagree) of the respondents do not hold the same opinion. A Chi-squared value of 16 at a  $>0.001$  level of significance means that the distribution of responses for this item falls within the accepted norm. This implies that more respondents are in agreement with the statement than the expected split half.

The results for statement 2 indicate that 52% and 15% strongly agree and agree respectively with the statement: *I am free to express my opinion in the Physical Science class*. This indicates that 67% of the respondents hold the view that there is freedom of expression in the class. However, 32, 7% (disagree and strongly disagree) raise a degree of concern as far as freedom of expression is concerned. This indicates that approximately one third of the respondents feel that they are not completely free to air their opinions. A Chi-squared value of 11.7 at a  $>0.001$  level of significance means that the distribution of responses for this item falls within the accepted norm. This implies that more respondents agree with the statement than the expected.

The results for statement 3 show that 45% and 19, 1% of respondents strongly agree and agree respectively with the statement: *In my school boys and girls learn Mathematics equally*. This indicates that 64.1% of the respondents hold the view that they learn Mathematics and Science equally with boys. On the other hand, 35% (disagree and strongly disagree) of the respondents disagree with the statement, which raises some concerns about the equality of education in the particular schools. A Chi-squared value of 8.2 at a  $>0.01$  level of significance means that the distribution of responses to this item fall within the acceptable norm. This implies that more respondents agree with the statement than the expected. Hence it can be accepted that more participants are of the opinion that boys and girls learn Mathematics equally.

The results for statement 4 indicate that 34% and 15% of respondents strongly agree and agree with the statement: *My parents discourage me to take Mathematics as my major in the future*. This indicates that 49% of the respondents experience some discouragement from their parents whether to take Mathematics as their major in future. At the same time 43.5% of the respondents (disagree and strongly disagree) of the respondents disagree with the statement. A Chi-squared value of 0.82 at a  $>0.5$  level of significance is lower than the expected Chi-squared value of 3.84 and this means that, the distribution of responses to this statement is close to or less than the expected value of split half. Hence the respondents who agree and disagree with the statement are almost equal.

The results for statement 5 indicate that 48, 7% and 33, 3% of respondents strongly agree and agree with the statement: *Boys discourage girls during Science practical work*. This indicates that 82% of participants experience some discouragement from boys during practical activities. A Chi-squared value of 41 at a  $>0.001$  level of significance means that the distribution of responses to this item fall within the acceptable norm. This implies that more respondents agree with the statement than the expected. Hence it can be accepted that more participants are of the opinion that boys discourage girls during Science practical work.

The result for statement 6 shows that 63.7% and 20, 6% of participants strongly agree and agree respectively with the statement: *My Mathematics teacher punishes us for not knowing the correct answer*. This indicates that 84, 3% of participants do receive some sort of punishment from their teachers if they do not know the answer. A Chi-squared value of 47 at a  $>0.001$  level of significance means that the distribution of responses to this item fall within the acceptable norm. This implies that more respondents agree with the statement than the expected. Hence it can be accepted that more participants are in agreement with the opinion that their teachers administer some kind of punishment if they do not know the correct answer.

The results for statement 7 indicate that 52% and 37, 5% of respondents strongly agree and agree respectively with the statement: *My Science teacher helps each and every individual learner with Science problems*. This infers that 89, 5% of the respondents do receive individual support from their educators if they experience Mathematical problems. A Chi-squared value of 47 at a  $>0.001$  level of significance means that the distribution of responses to this item fall within the acceptable norm. This implies that more respondents agree with the statement than the expected. Hence it can be accepted that more participants are of the opinion that their teacher renders individual help with their Science problems.

There is a 30% and 37, 2% of respondents who disagree and strongly disagree respectively with statement 8: *From primary school years I was discouraged by teachers to do Science*. This indicates that 67, 2% of the respondents received some kind of discouragement from the teachers in their choice of doing Science. A Chi-squared value of 15 at a  $>0.001$  level of significance means that the distribution of responses to this item falls within the acceptable norm. This implies that more respondents agree with the statement than the expected. Hence it can be accepted that more participants are of the opinion that from primary school years they were discouraged by teachers to do Science.



The results for statement 9 indicate that 46% and 34, 5 % of participants strongly agree and agree respectively with the statement: *My parents advice me to do commercial subject rather than Science*. This infers that 80.5 % of the girls are advised by parents to do commercial subjects. A Chi-squared value of 42 at a  $>0.001$  level of significance means that the distribution of responses to this item fall within the acceptable norm. This implies that more respondents agree with the statement than the expected. Hence it can be accepted that more participants are of the opinion that their parents advice them to do commercial subjects rather than Science.

The results for statement 10 reveal that 53% and 33% of the participants strongly disagree and disagree respectively with statement: *I got support from my parents on Mathematics problems that proved difficult*. This indicates that 86% of girls do not get support from parents with their Mathematical problems. A Chi-squared value of 59 at a  $>0.001$  level of significance means that the distribution of responses to this item fall within the acceptable norm. This implies that more respondents disagree with the statement than the expected. Hence it can be accepted that more participants are of the opinion that they do not get support from parents on Mathematical problems.

#### **4.3.4 Culture and tradition**

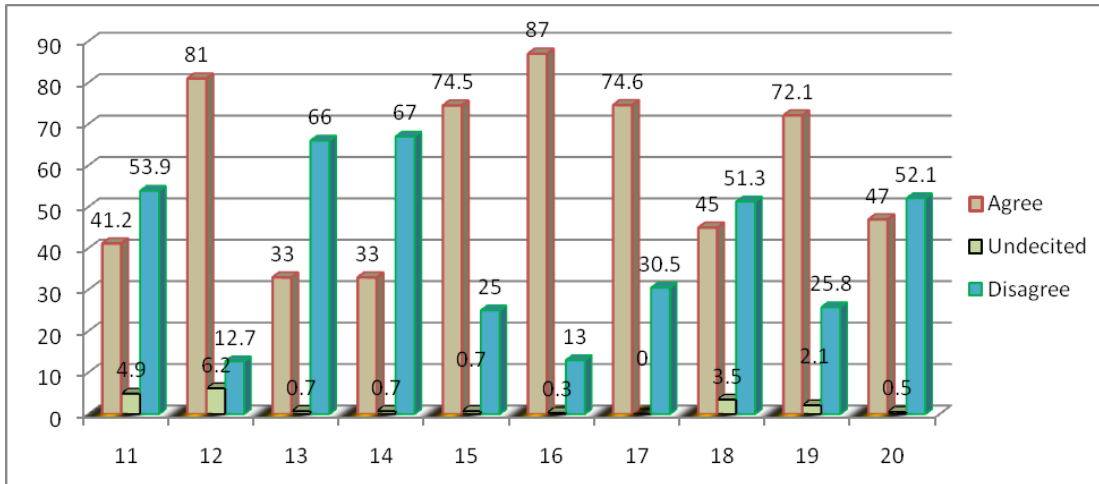
The table below shows responses for the ten statements of sub-question 1.4.1.2: *What cultural or traditional inheritable norms is there that hinder girls' interest in Science and Mathematics?* The results are tabulated as frequencies for Strongly Agree, Agree, Undecided, Disagree and Strongly Disagree with the corresponding percentages in brackets.

**Table 4.5 Result for statement 11 to 20**

Statement. No	Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree	Non-response
11) In my culture women are <b>allowed</b> to become scientists.						
	240 (16,6)	355 (24,6)	70 (4,9)	237 (16,4)	540 (37,5)	0 (0,0)
12) Some <b>cultural beliefs</b> in my community are in <b>conflict</b> with the opinion that girls can do Science.						
	740 (51)	429 (30)	90 (6,2)	105 (7,7)	76 (5)	2 (0,14)
13) In my tradition girls are regarded as <b>competent/capable</b> in Science as boys.						
	280 (19)	200 (14)	10 (0,7)	232 (16)	720 (50)	0 (0,0)
14) In my culture girls are <b>free to do</b> Mathematics.						
	241 (17)	235 (16)	7 (0,7)	459 (32)	500 (35)	0 (0,0)
15) According to my tradition, it is <b>more important</b> for boys to achieve in Science than for girls.						
	641 (44,5)	432 (30)	10 (0,7)	157 (11)	199 (14)	3 (0,2)
16) I find it <b>worthless</b> to work hard in Science because my future is not there.						
	821 (57)	429 (30)	5 (0,3)	102 (7)	85 (6)	0 (0,0)
17) According to my culture, girls are <b>expected</b> to take subjects that are related to domestic science.						
	751 (52)	326 (22,6)	0 (0,0)	185 (12,8)	180 (12,7)	0 (0,0)
18) My tradition <b>expects</b> boys and girls to have <b>equal</b> job opportunities in the Science field.						
	321 (22,3)	328 (22,7)	50 (3,5)	485 (33,6)	255 (17,7)	3 (0,2)
19) In my culture, housework is a <b>normal activity</b> for girls.						
	628 (43,6)	411 (28,5)	30 (2,1)	250 (17,3)	123 (8,5)	0 (0,0)
20) My traditional leaders <b>motivate</b> girls to do Mathematics.						
	390 (27)	285 (20)	6 (0,5)	335 (22,4)	426 (29,7)	0 (0,0)

The bar-chart below shows the percentage of strongly agree together with agree and undecided alone, while strongly disagree and disagree are together for statements 11 to 20.

**Chart 4.2 Bar-chart for statement 11 to 20**



**Table 4.6 Chi-squared value for statement 11-20**

Statement	11	12	13	14	15	16	17	18	19	20
Chi-squared value	1.9	33	10	11.56	24	54	25	0.5	21	0.27
Level of significance	>0.20	>0.001	<0.001	>0.001	>0.001	>0.001	>0.001	0.5	>0.001	>0.70

For statements 12-17, the level of significance is higher than the expected value of 0.05 except statements 11, 18 and 20 which have lower level. This high level suggests that the numbers of respondents who are in agreement with the statements are more than the expected value of split half.

#### 4.3.4.1 Presentation of results for Table 4.5

The results for statement 11 indicate that 16, 6% and 24, 6% of the participants strongly agree and agree respectively with statement: *In my culture women are allowed to become Scientist*. This indicates that 41, 2% of the respondents' cultures allow them to pursue

Science careers. The other 16, 4% and 37, 5% of the participants disagree and strongly disagree respectively which implies that there are some cultural norms that do not allow them to become scientist. A Chi-squared value of 1.9 at a  $>0.2$  level of significance means that the distribution of responds to this item fall short of the acceptable norm. This implies that the respondents who disagree and those who agree with the statement are almost even. Hence it can be accepted that almost equal numbers of participants agree and disagree.

The results for statement 12 shows that 51% and 30% of the respondents strongly agree and agree respectively with the statement: *Some cultural beliefs in my community are in conflict with the opinion that girls can do Science*. This indicates that there are cultural beliefs in the communities from where these respondents come from that are in conflict with the idea of girls doing Science. A Chi-squared value of 33 at a  $>0.001$  level of significance means that the distribution of responses to this item fall within the acceptable norm. This implies that more respondents agree with the statement than the expected. Hence it can be accepted that more participants are of the opinion that some cultural beliefs in their community are in conflict with the idea that girls can do Science.

The results for statement 13 shows that 16% and 50% of participants disagree and strongly disagree respectively with the statement: *In my tradition girls are regarded as competent/capable in Science as boys*. This indicates that in the traditions of these girls, they are not seen as competent or capable enough to do Mathematics and Science. A Chi-squared value of 10 at a  $<0.001$  level of significance means that the distribution of responses to this item fall within the acceptable norm. This implies that more respondents disagree with the statement than the expected. Hence it can be accepted that more participants are of the opinion that girls are not regarded as competent/capable in Science as boys.

There is a 32% and 35% of the participants who disagree and strongly disagree with statement 14: *In my culture girls are free to do Mathematics*. This indicates that there is a degree of oppression or discrimination against women doing Mathematics in these cultures. A Chi-squared value of 11. 56 at a  $>0.001$  level of significance means that the distribution

of responses to this item fall within the acceptable norm. This implies that more respondents disagree with the statement than the expected. Hence it can be accepted that more participants are of the opinion that in their cultures girls are not free to do Mathematics.

The responses for statement 15 which state that: *According to my tradition it is more important for boys to achieve in Science than for girls*, show that 44, 5% and 30% of participants strongly agree and agree respectively. This indicates that traditionally there is more support to boys that achieves in Mathematics and Science than to a girl. A Chi-squared value of 15 at a  $>0.001$  level of significance means that, the distribution of responses to this item fall within the acceptable norm. This implies that more respondents agree with the statement than the expected. Hence it can be accepted that more participants are of the opinion that achievement by boys in Science is valued more than achievement by girls.

On their future in Science, 57% and 30% of the participants strongly agree and agree respectively with statement 16: *I find it worthless to work hard in Science because my future is not there*. A Chi-squared value of 54 at a  $>0.01$  level of significance means that the distribution of responses to this item fall within the acceptable norm. This implies that more respondents agree with the statement than the expected. Hence it can be accepted that more participants are of the opinion that they do not work hard in Science because their future is not in Science.

There is a 52% and 22, 6% of respondents agreeing and strongly agreeing respectively with the statement 17: *According to my culture, girls are expected to take subject that are related to domestic science*. It can be inferred that there are cultural expectations that suggest that domestic science is a subject for females. A Chi-squared value of 25 at a  $>0.001$  level of significance means that the distribution of responses to this item falls within the acceptable norm. This implies that more respondents agree with the statement than the

expected. Hence it can be accepted that more participants are of the opinion that their cultures expect them to take subjects that are related to domestic Science.

The results for statement 18 show that 33, 6% and 17, 7% of responses disagree and strongly disagree with this statement: *My tradition expects boys and girls to have equal job opportunities in the science fields.* This indicates that half of the participants agree while the other half does not agree. A Chi-squared value of 0.5 at a 0.5 level of significance means that the distribution of responds to this item does not fall within the acceptable norm. This implies that the respondents that agree and those that disagree with the statement are closer to the expected. Hence almost equal amount of participants agree and disagree with the statement.

The results for statement 19 indicate that 43, 6% and 28, 5% of the participants strongly agree and agree respectively with the statement: *In my culture house work is a natural activity for girls.* This indicates that there are different preferences of household work that is regarded more naturally done by girls than by boys. A Chi-squared value of 21 at a  $>0.001$  level of significance means that the distribution of responses to this item fall with in the acceptable norm. This implies that more respondents agree with the statement than the expected. Hence it can be accepted that more participants are of the opinion that house work is a natural activity for girls.

The results for statement 20 show that 22, 4% and 27, 7% of participants disagree and strongly disagree with the statement: *My traditional leaders motivate girls to do Mathematics.* This means that half of the participants are of the opinion that traditional leaders motivate them to take part in Mathematics, while the other half is not motivated. A Chi-squared value of 0.27 at a  $>0.70$  level of significance means that the distribution of responses to this item does not fall within the acceptable norm. This implies that almost even number of respondents agree and disagree with the statement respectively.

#### 4.3.5 Beliefs and self-image of girls.

The table below shows responses for the ten statements of sub-question 1.4.1.3: *What positive or negative beliefs and self-image do girls have about Mathematics and Science?*

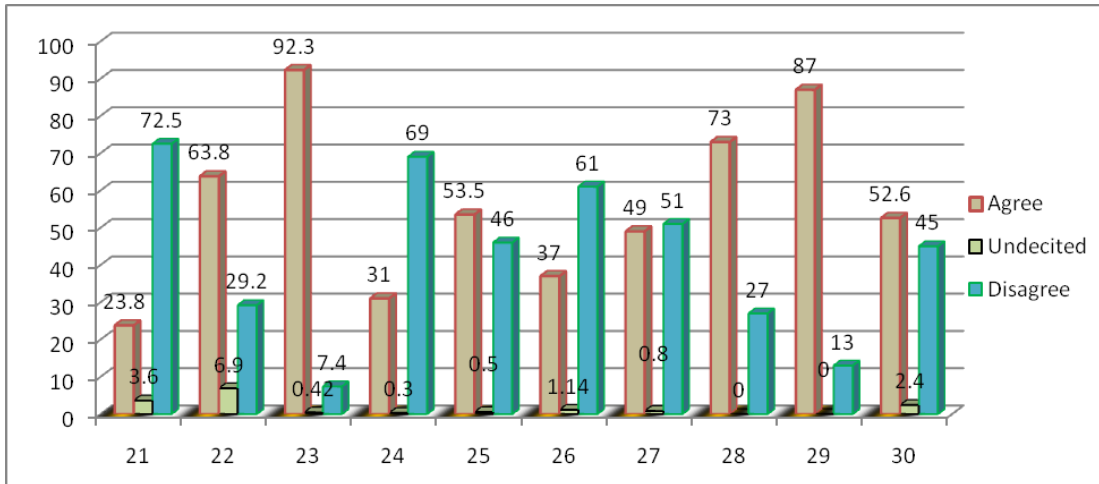
The results are tabulated as frequencies for Strongly Agree, Agree, Undecided, Disagree and Strongly Disagree with the corresponding percentages in brackets.

**Table 4.7 Results for statement 21 to 30**

Statement No	Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree	Non-response
21) I do Science with <b>confidence</b> .						
	193 (13,4)	150 (10,4)	52 (3,6)	666 (46,2)	379 (26,3)	2 (0,1)
22) I <b>underestimate</b> my <b>ability</b> to do Science.						
	640 (44,4)	280 (19,4)	100 (6,9)	288 (20)	133 (9,2)	1 (0,07)
23) I have <b>no future</b> with Mathematics.						
	820 (57)	509 (35,3)	6 (0,42)	55 (3,8)	52 (3,6)	0 (0,0)
24) Girls in my school are <b>willing</b> to do Science.						
	245 (17)	201 (14)	4 (0,3)	660 (46)	330 (23)	2 (0,14)
25) I <b>believe</b> that it is an unusual practice for girls to do Science.						
	345 (24)	425 (29,5)	7 (0,5)	385 (27)	280 (19)	0 (0,0)
26) Mathematics is very <b>important</b> for my future career.						
	230 (15)	320 (22)	2 (1,14)	450 (31)	436 (30)	4 (0,3)
27) Boys and girls have <b>equal</b> Mathematical abilities.						
	330 (23)	370 (26)	11 (0,8)	428 (30)	300 (21)	3 (0,2)
28) If I have a <b>choice</b> between Scientific studies and Commercial studies, I would do commercial studies.						
	740 (51)	320 (22)	0 (0,0)	158 (12)	220 (15)	4 (0,3)
29) Mathematics is <b>too complicated</b> for my understanding.						
	820 (57)	431 (30)	0 (0,0)	101 (7)	90 (6)	0 (0,0)
30) I think I can <b>contribute</b> to solving complex Mathematical problems in class.						
	427 (29,6)	337 (23)	30 (2,4)	300 (21)	348 (24)	0 (0,0)

The bar-chart below shows the percentage of strongly agree together with agree and undecided alone, while strongly disagree are together with disagree for statement 21 to 30.

**Chart 4.3 Bar-chart for statement 21 to 30**



**Table 4.8 Chi-squared value for statement 21-30**

Statement	21	22	23	24	25	26	27	28	29	30
Chi-squared value	24	12	72	14	0.57	5.8	0.04	21	55	0.6
Level of significance	>0.001	>0.001	>0.001	>0.001	0.5	<0.10	>0.9	>0.001	>0.001	<0.5

For statements 21, 22, 23, 24, 28 and 29 the Chi-squared value is high while statements 25, 26, 27, 30 the Chi-squared value is less than the expected level of 3.85. This suggests that most responses fall within the accepted level of significance.

#### 4.3.5.1 Presentation of results for Table 4.7

The results for statement 21, *I do science with confidence*, shows that 46, 2% and 26, 3% of girls disagree and strongly disagree. This indicates that 72, 5 % of the participants lack confidence to do Science. A Chi-squared value of 24 at a >0.001 level of significance means that the distribution of responses to this item fall within the acceptable norm. This



implies that more respondents disagree with the statement than the expected. Hence it can be accepted that more participants are of the opinion that they have no confidence in doing Science.

The results for statement 22 shows that 44, 4% and 19, 4% of the participants strongly agree and agree respectively with the statement: *I under estimate my ability to do science*. This indicates that 63, 8% of the participants underestimate their ability to do Science. A Chi-squared value of 12 at a  $>0.001$  level of significance means that the distribution of responses to this item fall within the acceptable norm. This implies that more respondents agree with the statement than the expected. Hence it can be accepted that more participants are of the opinion that they under estimate their ability to do Science.

On their future in Mathematics, 57% and 35, 3% of the participants strongly agree and agree respectively with statement 23: *I have no future with Mathematics*. This indicates that a resounding 92, 3% of respondents have no ambition, no desire in future to have careers in Mathematics. A high Chi-squared value of 72 at  $> 0,001$  level on significance means that the distribution of responses to this statement falls within the acceptable norm. It can therefore be concluded that the majority of the respondents agree that they have no future with Mathematics.

The results in statement 24 show that 46% and 23% of the participants disagree and strongly disagree respectively with the statement: *Girls in my school are willing to do Science*. This indicates that there is a general lack of interest in Mathematics among girls in these schools. A Chi-squared value of 72 at a  $>0.001$  level of significance means that the distribution of responses to this item fall with in the acceptable norm. This implies that more respondents agree with the statement than the expected. It can therefore be accepted that more participants are of the opinion that they do not have any future with Mathematics.

The results for statement 25 indicate that 24% and 29, 5% of the participants strongly agree and agree respectively with the statement: *I believe that it is an unusual practice for girls to do Science*. This indicates that there is a belief among girls that it is an unusual practice and

it does not confine to normal standards of the community for a girl to do Science. A Chi-squared value of 0.57 at a 0.5 level of significance means that the distribution of responses to this item does not fall within the acceptable norm. This implies that almost equal amount of respondents agree and disagree with the statement respectively. Hence it can not be accepted that more participants are of the opinion that it is unusual for girls to do Science.

The results for statement 26 shows that 31% and 30% of the respondents disagree and strongly disagree respectively with the statement: *Mathematics is very important for my future*. This indicates that the participants undervalue Mathematics for their future. About 61% of the participants do not see the need for Mathematics in their future while 15% and 22% see the need of Mathematics for their future careers. A Chi-squared value of 5.8 at a  $<0.10$  level of significance means that the distribution of responses to this item fall within the acceptable norm. This implies that more respondents disagree with the statement than the expected. It can be therefore accepted that more participants are of the opinion that Mathematics is not important for their future.

The responses in statement 27 shows 30% and 21% of the participants disagree and strongly disagree respectively with the statement: *Boys and girls have equal Mathematical ability*. On the other hand, 23% and 26% of the participants strongly agree and agree respectively. The percentage of girls is almost split in half for this statement which indicates that some girls regard themselves as less capable than boys while others see themselves as equally capable. A Chi-squared value of 0.04 at a  $>0.09$  level of significance means that the distribution of responses to this item does fall within the acceptable norm. This implies that almost equal number of respondents agree and disagree with the statement respectively.

The results in statement 28 shows that 51% and 22% of the responses strongly agree and agree respectively with the statement: *If I have a choice between science studies and commercial studies, I will do commercial studies*. This indicates that 73 % of the participants would not opt for the science field of studies if they had a choice. A Chi-

squared value of 28 at a  $>0.001$  level of significance means that the distribution of responses to this item fall within the acceptable norm. This implies that more respondents agree with the statement than the expected. It can be accepted that more participants are of the opinion that they will opt for commercial subject rather than Science.

On the complexity of Mathematics, 57% and 30% of the participants strongly agree and agree respectively with the statement 29: *Mathematics is too complicated for my understanding*. This indicates that 87% of the participants regard Mathematics as a complicated subject. A Chi-squared value of 55 at a  $>0.001$  level of significance means that the distribution of responses to this item fall within the acceptable norm. This implies that more respondents agree with the statement than the expected. Hence it can be accepted that more participants are of the opinion that Mathematics is too complicated for them.

The results for statement 30 shows that 29, 6% and 23% of the girls strongly agree and agree respectively with the statement: *I think I can contribute to solving complex Mathematics problems in class*. This indicates that almost half of the participants believe that they can contribute to solving Mathematics problems, but 21% and 24% of girls believe that they cannot contribute to solving Mathematical problems and this is quite a significant number. A Chi-squared value of 0.6 at a  $<0.5$  level of significance means that the distribution of responses to this item fall within the acceptable norm. This implies that the same number of respondents agrees with the statement than the expected. Hence more participants are of the opinion that boys and girls learn Mathematics equally.

#### **4.3.6 Male domain and girls' attitudes**

The table below shows responses for the ten statements of sub-question 1.4.1.4. *What are the attitudes of girls towards Mathematics and Science?*

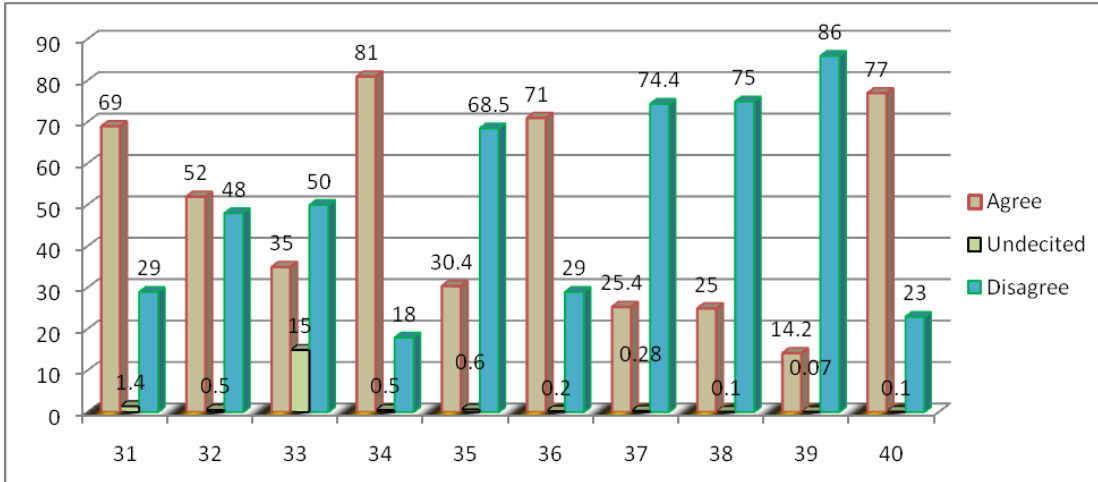
The results are tabulated as frequencies for Strongly Agree, Agree, Undecided, Disagree and Strongly Disagree with the corresponding percentages in brackets.

**Table 4.9 Results for statement 31 to 40**

Statement. No	Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree	Non-response
31) It is quite normal for boys to perform <b>better</b> than girls in Mathematics.	566 (39)	439 (30)	20 (1,4)	288 (20)	129 (9)	0 (0,0)
32) It is possible for girls to perform <b>better</b> than boys in Science practical tests.	430 (30)	320 (22)	17 (0,5)	490 (34)	194 (14)	1 (0,07)
33) When a girl outperforms the whole class in a Science test, she will be <b>teased</b> by the class mates.	271 (19)	225 (16)	218 (15)	348 (24)	380 (26)	0 (0)
34) Whenever a measurement has to be done in Science practical work, a boy <b>does</b> it.	750 (52)	411 (29)	7 (0,5)	170 (11,8)	102 (7)	2 (0,1)
35) In Science practical work boys and girls <b>share</b> tasks equally.	288 (20)	150 (10,4)	9 (0,6)	568 (39)	426 (29,5)	1 (0,07)
36) Science lessons are <b>boring</b> .	514 (36)	485 (35)	3 (0,2)	220 (15)	218 (14)	2 (0,1)
37) I <b>enjoy</b> reading Science-related publications	211 (15)	150 (10,4)	4 (0,28)	511 (35,4)	564 (39)	2 (0,1)
38) I think Mathematics is an <b>easy</b> subject to understand.	200 (14)	168 (11)	2 (0,1)	532 (37)	540 (38)	0 (0,0)
39) I <b>like</b> Science programmes on TV.	98 (7)	104 (7,2)	1 (0,07)	398 (28)	839 (58)	2 (0,1)
40) <b>Mathematical games</b> are for boys.	620 (43)	491 (34)	2 (0,1)	132 (9)	197 (14)	0 (0,0)

The bar-chart below shows the percentage of strongly agree together with agree and undecided alone, while strongly disagree and disagree are together for statement 31 to 40.

**Chart 4.4 Bar-chart for statement 31 to 40**



**Table 4.10 Chi-squared value for statement 31-40**

Statement	31	32	33	34	35	36	37	38	39	40
Chi-squared value	16	0.16	5	38	15	15	24	25	52	29
Level of significance	>0.001	>0.7	<0.5	>0.001	>0.001	>0.001	>0.001	>0.001	>0.001	>0.001

The majority of these statements have a high Chi-squared value above the expected value of 3.84 except statement 32. This suggests that the majority of the responses fall within the acceptable norm.

**4.3.6.1 Presentation of results for Table 4.9**

The results for statement 31 indicate that 39% and 30% of the participants strongly agree and agree respectively with the statement: *It is quite normal for a boy to perform better than girls in Mathematics*. This gives a total of 69% of the girls who are of the opinion that

it is normal for boys to perform better than girls in Mathematics. A Chi-squared value of 16 at a  $>0.001$  level of significance means that, the distribution of responds to this item fall within the acceptable norm. This implies that more respondents agree with the statement than the expected. Hence it can be accepted that more participants are of the opinion that it is normal for boys to perform better than girls in Mathematics.

For statement 32, 30% and 22% of the participants strongly agree and agree respectively with the statement: *It is possible for girls to perform better than boys in Science practical test*. This indicates that more than half of the participants are of the opinion that the possibility exist for a girl to out-perform a boy in practical work. On the other hand, 34% and 14% of the girls disagree and strongly disagree with the statement. A Chi-squared value of 0.16 at a  $>0.7$  level of significance means that the distribution of responses to this item falls within the acceptable norm. This implies that the same number of respondents agrees and disagrees with the statement respectively.

The results in statement 33 shows that 24% and 26% of the respondents disagree and strongly disagree respectively with the statement: *When a girl outperforms the whole class in Science test, she will be tease by the class mates*. This indicates that almost half of the girls did not experience teasing after a good performance, but 19% and 16% of girls disagree and strongly disagree respectively which suggests that they were teased when they out-performed boys in a science test. A Chi-squared value of 5 at a  $<0.5$  level of significance means that the distribution of responds to this item fall with in the acceptable norm. This implies that equal numbers of respondents agree and disagree with the statement as the expected. This is mainly due to a lot of undecided responses in this statement. Hence it can be accepted that equal participants are of the opinion or against the opinion that girls are teased by class mates if they do well in Science.

On practical work in Science, 52% and 29% of the participants strongly agree and agree respectively with statement 34: *Whenever a measurement has to be done in Science practical work, a boy does it*. This indicates that 81% of the respondents are of the opinion

that teachers asked more boys to perform tasks than girls. A Chi-squared value of 38 at a  $>0.001$  level of significance means that the distribution of responses to this item fall within the acceptable norm. This implies that more respondents agree with the statement than the expected. Hence it can be accepted that more participants are of the opinion that boys do most measurements in Science practical work.

The results for statement 35 indicate that 39% and 29, 5% of the participants disagree and strongly disagree respectively with the statement: *In science practical work boys and girls share tasks equally*. This indicates that 68, 5% of the participants do not see equality in their class as far as sharing of tasks is concerned. A Chi-squared value of 15 at a  $>0.001$  level of significance means that the distribution of responses to this item falls within the acceptable norm. This implies that more respondents disagree with the statement than the expected. Hence it can be accepted that more participants are of the opinion that there is no equality in sharing of tasks between boys and girls.

The results in statement 36 suggest that 35% and 36% of the participants strongly agree and agree respectively with the statement: *Science lessons are boring*. There is a total of 71% of the participants who regard Science lessons as boring. A Chi-squared value of 15 at a  $>0.001$  level of significance means that the distribution of responses to this item fall within the acceptable norm. This implies that more respondents agree with the statement than the expected. Hence it can be accepted that more participants are of the opinion that Science lessons are boring.

There is a 35, 4% and 39% of the participants who disagree and strongly disagree respectively with the statement 37: *I enjoy reading science related publications*. A total of 74, 4% of the respondents do not like reading publications on science-related topics. A small portion of about 25, 4% of the respondents do enjoy reading publications on science related topics. A Chi-squared value of 8.2 at a  $>0.01$  level of significance means that the distribution of responses to this item falls within the acceptable norm. This implies that more respondents disagree with the statement than the expected. Hence it can be accepted

that more participants are of the opinion that they do not enjoy reading science related publications.

The responses in statement 38 show that 35% and 36% of the participants disagree and strongly disagree respectively with the statement: *I think Mathematics is an easy subject to understand*. A total of 71% of the girls regard Mathematics as complicated and difficult subjects to understand. A Chi-squared value of 25 at a  $>0.001$  level of significance means that the distribution of responses to this item falls within the acceptable norm. This implies that more respondents disagree with the statement than the expected. Hence it can be accepted that more participants are of the opinion that Mathematics is not easy to understand.

The results for statement 39 indicate that 28% and 58% of the respondents disagree and strongly disagree respectively with the statement: *I like Science programmes on TV*. This shows a total of 86% of the respondents who do not like watching science-related programmes on TV. A Chi-squared value of 52 at a  $>0.001$  level of significance means that the distribution of responses to this item falls within the acceptable norm. This implies that more respondents disagree with the statement than the expected. Hence it can be accepted more participants are of the opinion that they do not like Science programmes on TV.

The results of statement 40 indicate that 43% and 34% of the participants strongly agree and agree respectively with the statement: *Mathematics games are for boys*. This shows that a total of 77% of the respondents regard Mathematics games as games that should be played by boys. A Chi-squared value of 40 at a  $>0.001$  level of significance means that the distribution of responses to this item falls within the acceptable norm. This implies that more respondents agree with the statement than the expected. Hence it can be accepted that more participants are of the opinion that Mathematics games are for boys.



### 4.3.7 Tinkering activities

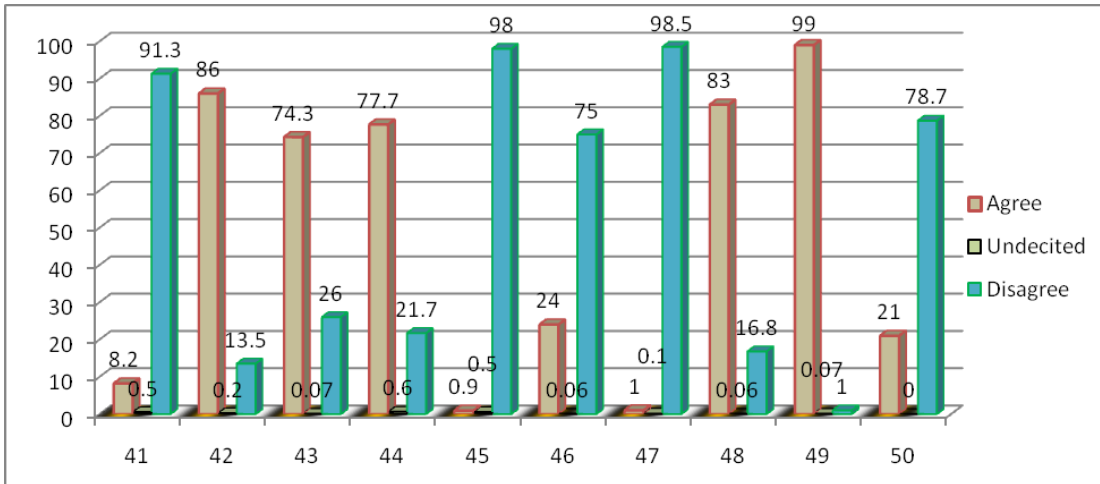
The table below shows responses for the ten statements of sub-question 1.4.1.5: *What type of tinkering activities are girls exposed to and how does it influence them towards Mathematics and Science?* The results are tabulated as frequencies for Strongly Agree, Agree, Undecided, Disagree and Strongly Disagree with the corresponding percentages in brackets.

**Table 4.11 Result for statement 41 to 50**

Statement. No	Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree	Non-response
41) During my childhood, I was <b>exposed</b> to playing counting games.	58 (4)	61 (4,2)	7 (0,5)	646 (44,8)	670 (46,5)	0 (0,0)
42) We <b>never</b> play mental challenging games at home.	991 (69)	251 (17)	3 (0,2)	100 (7)	94 (6,5)	3 (0,7)
43) During my childhood, I was <b>not exposed</b> to playing with toys.	639 (44,3)	428 (30)	1 (0,07)	288 (20)	86 (6)	0 (0)
44) Our Science classroom is <b>decorated</b> with nice challenging posters.	553 (38)	568 (39,7)	8 (0,6)	155 (10,7)	158 (11)	0 (0,0)
45) At home we <b>play computer games</b> that are Mathematically related.	5 (0,3)	10 (0,6)	7 (0,5)	105 (7)	1310 (91)	5 (0,4)
46) The teacher uses practical activities to <b>stimulate</b> us in Science.	200 (13)	156 (11)	1 (0,06)	500 (35)	582 (40)	1 (0,07)
47) One or both of my parents have a <b>career</b> in Science related fields.	8 (0,6)	6 (0,4)	2 (0,1)	668 (46)	757 (52,5)	1 (0,07)
48) My parents <b>never</b> buy me any Mathematics related books to read.	768 (53)	428 (30)	1 (0,06)	188 (13)	55 (3,8)	2 (0,1)
49) I in my life have <b>never</b> been to science <b>career orientation</b> .	421 (29)	1006 (70)	1 (0,07)	11 (0,8)	3 (0,2)	0 (0,0)
50) I have been to Science <b>fairs</b> many times	172 (12)	135 (9)	0 (0,0)	25 (1,7)	1110 (77)	1 (0,07)

The Bar-chart below shows the percentage of strongly agree with agree together and undecided alone, while strongly disagree are together with disagree for statement 41 to 50.

**Chart 4.5 Bar-chart for statement 41 to 50**



**Table 4.12 Chi-squared value for statement 41-50**

Statement	41	42	43	44	45	46	47	48	49	50
Chi-squared value	68	51	23	31	94	26	95	43	96	32
Level of significance	>0.001	>0.001	>0.001	>0.001	>0.001	>0.001	>0.001	>0.001	>0.001	>0.001

For statement 41-50 the Chi-squared value is above 3.84 which suggests that the majority of the responses to these statements fall within the accepted level of significance.

#### 4.3.7.1 Presentation of results for Table 4.11

High percentages of 44, 8% and 46, 5% of the participants disagree and strongly disagree respectively with statement 41: *During my childhood I was exposed to playing counting games*. A total of 91, 3% of participants were not exposed to counting games during their

childhood. A Chi-squared value of 68 at a  $>0.001$  level of significance means that the distribution of responses to this item falls within the acceptable norm. This implies that more respondents disagree with the statement than the expected. Hence it can be accepted that more participants are of the opinion that they were not exposed to playing counting games.

The responses for statement 42 indicate that 69% and 17% of the participants strongly agree and agree respectively with the statement: *We never play mental challenging games at home*. This implies that 86% of the participants are not involved in playing games that are mentally challenging. A Chi-squared value of 51 at a  $>0.01$  level of significance means that the distribution of responses to this item falls within the acceptable norm. This suggests that more respondents agree with the statement than the expected. Hence it can be accepted that more participants are of the opinion that they did not play mentally challenging game at home.

The results in statement 43 show that 44, 3% and 40% of the participants strongly agree and agree respectively with the statement: *During my childhood I was not exposed to playing with toys*; indicates. This suggests that 84, 3% of the participants are not exposed to toys. On the other hand 20% and 6% of girls disagree and strongly disagree. A Chi-squared value of 23 at a  $>0.001$  level of significance means that the distribution of responses to this item falls within the acceptable norm. This implies that more respondents agree with the statement than the expected. Hence it can be accepted that more participants are of the opinion that they were not exposed to playing with toys during their childhood.

The responses in statement 44: *Our science classroom is decorated with nice challenging posters* indicate that 38% and 39, 7% of the participants strongly agree and agree respectively. This means that 75, 7% of the participants agree that Science classes are equipped with posters that are subject related and challenging. A Chi-squared value of 31 at a  $>0.001$  level of significance means that the distribution of responses to this item fall within the acceptable norm. This implies that more respondents agree with the statement

than the expected. Hence more participants are of the opinion that their science classrooms are decorated with nice challenging posters.

On Mathematics related games, 7% and 91% of the respondents disagree and strongly disagree respectively with statement 45: *At home we play computer games that are mathematically related*. A total of 98% of participants is not exposed to computer games that are related to Mathematics. A Chi-squared value of 94 at a  $>0.001$  level of significance means that the distribution of responses to this item falls within the acceptable norm. This implies that more respondents disagree with the statement than the expected. Hence it can be accepted that more participants are of the opinion that they do not play games at home that are mathematically related.

The responses for statement 46 indicate that 35% and 40% of the participants disagree and strongly disagree respectively with the statement: *The teacher used practical activities to stimulate us in Science*. This indicates that teachers do not use stimulating practical work to stimulate learners' curiosity. A Chi-squared value of 26 at a  $>0.001$  level of significance means that the distribution of responses to this item falls within the acceptable norm. This implies that more respondents disagree with the statement than the expected. Hence it can be accepted that more participants are of the opinion that teachers do not use practical activities to stimulate them.

The responses for statement 47: *One or both my parents have a career in Science related fields*, show 46% and 52, 5% of the participants disagree and strongly disagree respectively, totalling 98% of the respondents who have parents that do not have a career in Mathematics and Science. A Chi-squared value of 95 at a  $>0.001$  level of significance means that the distribution of responses to this item falls within the acceptable norm. This implies that more respondents disagree with the statement than expected. Hence it can be accepted that more participants are of the opinion that their parents have no career in Science what so ever.

Regarding Mathematics books, 53% and 30% of the participants strongly agree and agree respectively with the statement 48: *My parents never buy me any Mathematics books to read*; this gives a total of 83% of participants who do not get books from parents on Mathematics related topics. A Chi-squared value of 43 at a  $>0.001$  level of significance means that the distribution of responses to this item falls within the acceptable norm. This implies that more respondents agree with the statement than the expected. Hence it can be accepted that more participants are of the opinion that their parents do not buy them Mathematics books to read.

On career orientation, 29% and 70% of the participants agree and strongly agree with statement 49: *I have never been to Science career orientation in my life*, resulting in a total of 99% of the respondents that has never been at a Science fair. A Chi-squared value of 96 at a  $>0.001$  level of significance means that the distribution of responses to this item falls within the acceptable norm. This implies that more respondents agree with the statement than the expected. Hence more participants are of the opinion that they have never been to Science career orientation in their life.

The responses in statement 50 show that 77% and 1, 7% of the respondents strongly disagree and disagree with the statement, *I have been to science fair many times*. This indicates that a total of 79% of the participants has not been to Science fair. A Chi-squared value of 32 at a  $>0.001$  level of significance means that the distribution of responses to this item falls within the acceptable norm. This implies that more respondents disagree with the statement than the expected. Hence it can be accepted that more participants are of the opinion that they have never been to a science fair before.

## 4.4 FINDINGS

### 4.4.1 Introduction

The main research question and the sub-questions as presented in Chapter 1 are repeated here.

#### **Research question:**

What are the socio-cultural factors that prevent girls from progressing in the fields of Mathematics and Science in Namibia?

#### **Sub-questions:**

- 1) What positive or negative influence do girls have about Mathematics and Science?
- 2) What cultural and traditional inheritable norms are there that hinder girls' interest in Mathematics/ Science?
- 3) What positive/negative beliefs and self-image do girls have about Mathematics and Science?
- 4) What are the attitudes of girls towards Mathematics and Science?
- 5) What type of tinkering activities are girls exposed to and how do they influence them towards Mathematics and Science?

The findings will be discussed according to the following headings:

- Influence from teachers and parents;
- Culture and tradition;
- Beliefs and self-image;
- Male domain and girls' attitudes; and
- Tinkering activities.

### 4.4.2 Influence from teachers and parents

**Statement 1:** *The Science teacher often asks boys questions rather than girls.*

This statement was stated relatively negative and the expected response is that most girls would not agree that teachers ask more questions to boys than to them.

*A high number of respondents (70.1%) that agree that teachers ask boys more questions than girls implies that Science teachers in the particular schools do to a large extent differentiate between the two genders when asking questions.*

It can therefore be concluded that educators discriminate between genders as far as the frequency of asking questions is concerned. More questions are directed to boys than to girls.

**Statement 2:** *I am free to express my opinion in the Physical Science class.*

This statement was stated positively and the expected response was that most respondents would agree that they were free to express their opinion in the Physical Science class.

*Although 67% of the respondents agree that they are free to express their opinion in the Physical Science class, a substantial number of respondents (32%) is of the opinion that they are not free to express their views. This implies that this issue needs some attention to improve the level of freedom of expression.*

It can therefore be concluded that although many of respondents agree that they can express themselves freely, there is not complete freedom of expression in all Physical Science classes.

**Statement 3:** *In my school boys and girls learn Mathematics equally.*

This statement was stated positively and the expected response was that most respondents would agree that in their school boys and girls learn Mathematics equally.

*Although 64.1% of the respondents agree that in their schools boys and girls learn Mathematics equally, a 35% of the respondents disagree with the statement. This implies that this issue needs some attention to improve the level of equality between the two genders.*

It can therefore be concluded that there is inequality in some schools as far as learning Mathematics is concerned.

**Statement 4:** *My parents discourage me to take Mathematics as my major in the future.*

This statement was stated negatively and the initial expectation was that almost all the respondents would strongly disagree with the statement.

*The results suggest that almost half of the responded (49%) agree that they are discouraged by parents not to take Mathematics in future. There is also a significant percentage (7, 4%) of undecided participants. The 43% of participants that disagree are relatively few for negatively stated statement like this one.*

It can therefore be concluded that there is a high level of discouragement from parents as far as girls taking up Mathematics for their futures is concerned.

**Statement 5:** *Boys discourage girls during Science practical work.* This statement was stated negatively and the expectation was that most of the participants would strongly disagree with the statement. A high percentage (82%) of the participants agrees with the statement, which implies that boys are discouraging girls during Science practical activities. It can therefore be concluded that girls are experiencing some degree of discouragement during Science practical work from boys.

**Statement 6:** *My Mathematics teacher punishes us for not knowing the correct answer.* This statement was stated negatively and the aim was to find out if teachers were punishing learners for not knowing the correct answer. Although it is not clear what type of punishment is administered to learners who do not know the answers, a high percentage (84, 3%) of the respondents agrees with the statement.

It can therefore be concluded that teachers are administering some form of punishment to learners who does not know answers.

**Statement 7:** *My Science teacher helps each and every individual learner with Science problems.* This statement was stated positively and it was expected that the majority of the respondents would agree with the statement. A high percentage (89, 5%) of participants agrees with the statement. The conclusion can be reached that these learners received support from their Science teacher for their Science problems.

**Statement 8:** *From primary school years I was discouraged by teachers to do Science.* This statement was stated negatively, the expectation was that most participants would disagree with the statement. Although 67. 2% of the respondents disagree with the statement, 27,4% of the participants agree with this statement. It can therefore be concluded that some teachers from primary school years discourage learners not to take up Science.

**Statement 9:** *My parents advise me to do commercial subject rather than Science.* This statement was stated such that it tests the parents' advice to their children as far as the choice between Commercial subjects and Science is concerned. The results portray a high percentage of 80, 5% of the learners who agree with the statement. The conclusion can be



reached that most parents advise their daughters to take commercial subjects rather than Science.

**Statement 10:** *I got support from my parents on Mathematics problems that proved difficult.* This statement was positive and the expectation was that most participants would agree with it. *Nevertheless 86% of the respondents disagree with the statement. Only 12, 4% of the participants agree with the statement.* It can therefore be concluded that very few parents support their children that have difficulties with Mathematics problems.

#### **4.4.3 Cultures, traditions and upbringings of girls**

**Statement 11:** *In my culture women are allowed to become Scientist.* The expected response for this statement was that most participants would agree, because that would reveal the cultural freedom that they have. *More than half (53. 9%) of the participants disagree with the statement, only 41.2% of the participants agree.* It can therefore be concluded that the culture of the participants have some limitations as far as freedom of women to become scientist is concerned.

**Statement 12:** *Some cultural beliefs in my community are in conflict with the opinion that girls can do Science.* This statement was rather negative, and it was therefore expected that most participants would disagree with it. The aim was to examine if there is any cultural belief that is in conflict with Science. *Although the statement is negative, 81% of the participants agree with the statement.* It can therefore be concluded that there are some cultural beliefs that are in conflict with the idea that girls can do Science.

**Statement 13:** *In my tradition girls are regarded as competent/capable in Science as boys.* This statement was relatively positive and the expectation was that most participants would agree with it. *Nevertheless, 66% of the participants disagree with the statement and only 33% agree. This shows that in these traditions Science has been given a masculine look.* It can therefore be concluded that in these traditions, a great number of people regard women as incompetent in doing Science.

**Statement 14:** *In my culture girls are free to do Mathematics.* This statement was stated relatively positive and the expectation was that most of the participants would agree with it. *On the contrary, 67% of the participants disagree with the statement.* It can therefore be

concluded that there are cultural hindrances that do not give liberty to girls to pursue Mathematics.

**Statement 15:** *According to my tradition it is more important for boys to achieve in Science than for girls.* This statement was negatively stated and the expectation was that most participants would disagree with it. *On the contrary, 74, 5% of the respondents agree with the statement and only 25% disagree. This implies that the traditions of the participants in a way value the achievement of boys more than that of girls regarding Science.* It can therefore be concluded that the traditions of most of these participants give more preference to the male achievement than female achievement.

**Statement 16:** *I find it worthless to work hard in Science because my future is not there.* This statement was aiming at finding out whether the participants have future ambitions with Science or not. *Although the expectation is that the participants would moderately disagree with the statement, on the contrary 87% of the participants agree with the statement.* It can therefore be concluded that the participants do not have future ambitions with Science but with some other fields of study.

**Statement 17:** *According to my culture girls are expected to take subject that are related to domestic science.* This statement was stated in such away as to give an impression that girls are linked to domestic work or studies. *Nevertheless, 74, 6% of the participants agree while only 30, 5% disagree. This is a high percentage of participants to agree with a statement that links girls to domestic work.* It can be therefore concluded that the cultural expectations of there participants is for girls to do subjects that are related to domestic science.

**Statement 18:** *My tradition expects boys and girls to have equal job opportunities in the science field.* This statement was stated positively and the expectation was that most participants would agree with it. *The result is almost split half with 45% agree and 51, 3% disagree.* The high percentage of participants disagreeing with this statement implies that there is no equality in these traditions in terms of job opportunities.

**Statement 19:** *In my culture house work is a normal activity for girls.* The aim of the statement was to finding out whether these cultures link house work with girls or not. *The results suggest that 72, 1% of respondents agree while 25, 8% disagree with the statement.*

It can be therefore concluded that the majority of the participants' culture regard house work as normal activities for girls

**Statement 20:** *My traditional leaders motivate girls to do Mathematics.* This statement is positively stated and the expectation was that most participants would agree with it. *Nevertheless the result is almost split in half, 47% agree and 52, 1% disagree.* It can therefore be concluded that there is a low level of encouragement from the traditional leaders.

#### **4.4.4 Beliefs and self-image**

**Statement 21:** *I do science with confidence.* The statement was stated positively and the expectation is that most participants would agree with it. *The result reveals that only 23, 8% agree while 72, 5% of the respondents disagree with the statement.* It can therefore be concluded that most of the respondents have no confidence in themselves doing Science.

**Statement 22:** *I under estimate my ability to do science.* This statement was negatively stated and the expectation was that most participants disagree with it. Nevertheless 63, 8% of the participants agree, while 29, 2% of them disagree. This implies that the majority of the girls under estimate their ability to do science.

**Statement 23:** *I have no future with Mathematics.* This statement was relatively negative and the expectation was that most participants would not agree with the statement. Although the statement was negatively stated, an overwhelming percentage of 92, 3% of participants agree that they have no future with Mathematics what so ever. It can therefore be concluded that the participants see no future with Mathematics.

**Statement 24:** *Girls in my school are willing to do Science:* This statement was positively stated and it aims at finding out the willingness of the participants to do Science. The responses reveal that 69% of the participants disagree with the statement. This implies that there is a lack of willingness among participants to do Science.

**Statement 25:** *I believe that it is an unusual practice for girls to do Science.* This statement was rather negative and the expectation was that the majority of the participants would disagree with the statement. *The result for this statement is almost split in half with 54, 5%*

*agreeing and 46% disagreeing.* It can therefore be concluded that nearly half of participants are of the opinion that it is unusual for girls to do Science.

**Statement 26:** *Mathematics is very important for my future.* This statement was stated positively and the expectation is that most of the participants would agree with it. *Nevertheless 61% of the respondents disagree and only 37% agree with it.* It can therefore be concluded that a high number of participants do not regard Mathematics as important for their future.

**Statement 27:** *Boys and girls have equal Mathematical ability.* This statement was stated positively. *Although the result is almost split in half (49% agree and 51% disagree) the expectation was that most of the respondents will agree with the statement.* It can therefore be concluded that more than half of the respondents do not agree with the fact that boys and girls have equal Mathematics ability.

**Statement 28:** *If I have a choice between science studies and commercial studies, I will do commercial studies.* This statement was stated in such a way as to measure the participant's choice of subject. *The responses reveal that 73% of the respondents agree and only 27% disagree with the statement.* It can therefore be concluded that the majority of the participants prefer to do commercial fields of studies rather than Science.

**Statement 29:** *Mathematics is too complicated for my understanding.* This statement was stated negatively and the expectation was that most participants will not agree with it. *On the contrary 87% of the participants agree with the statement that Mathematics is too complicated.* It can therefore be concluded that the majority of the respondents regard Mathematics as complicated.

**Statement 30:** *I think I can contribute to solving complex Mathematics problems in class.* This statement was positively stated and it aimed to find out the level of contribution among participants in challenging complex Mathematics problem. *The result is almost split in half with 52, 6% agreeing and 45% disagreeing.* It can therefore be concluded that half of the participants are of the opinion that they can solve complex Mathematics problems.

#### 4.4.5 Male domain and beliefs

**Statement 31:** *It is quite normal for a boy to perform better than girls in Mathematics.* The statement was negative and the expectation was that most of the respondents disagree with the statement. *The result shows that 69% of the participants agree with the statement while 29% disagree.* It can therefore be concluded that many of the girls are of the opinion that it is normal for boys to perform better than girls in Mathematics.

**Statement 32:** *It is possible for girls to perform better than boys in Science practical test.* The statement was stated positive and it aimed to find out whether the girls are of the opinion that they could perform better in science practical work than boys. *The result suggests a mix of opinions among participants, with 52% agreeing and 48% disagreeing with the statement.* It can be concluded that many of the participants agree with the statement.

**Statement 33:** *When a girl outperforms the whole class in Science test, she will be teased by the class mates.* This statement was negative and it is expected most of the participants to disagree with it. *The result suggests that 50% of the participants disagree and 35% disagree with the statement. There is a high percentage of undecided responses (15%).* It can therefore be concluded that half of the participants disagree with the teasing in class.

**Statement 34:** *Whenever a measurement has to be done in Science practical work, a boy does it.* This statement was negative and the expectation is that most of the respondents would disagree with it. *Nevertheless 81% of the participants agree with it and only 18% disagree with it.* It can therefore be concluded that measurements in Science practical work is predominantly done by boys.

**Statement 35:** *In science practical work boys and girls share tasks equally.* This statement was positive and the expectation was that most respondents would agree with it. *The result reveals that 68, 5% of the respondents disagree while 30, 4% of respondents agree with the statement.* It can therefore be concluded that there is no equal distribution of work between boys and girls in Science practical work.

**Statement 36:** *Science lessons are boring.* This statement was negative and the expectation was that most participants would disagree with the statement. *Although the statement is*

*stated so negative 71% of the participants agree with it and only 29% disagree. It can therefore be concluded that most participants regard Science lessons as boring.*

**Statement 37:** *I enjoy reading science related publications.* This statement was positive and the expectation was that most participants would agree with it. *A high number of respondents 74, 4% disagree and only 25, 4% agree. It can be therefore concluded that many participants do not read Science related publications.*

**Statement 38:** *I think Mathematics is an easy subject to understand.* This statement was stated positively and the expectation was that most participants would agree with it. *Although 25% of the respondents agree with the statement, a high percentage of 75% disagree with it. It can therefore be concluded that the majority regard Mathematics as a difficult subject to understand.*

**Statement 39:** *I like Science programmes on TV.* This statement was stated positively and the expectation was that most learners would agree with the statement. *On the contrary 86% of the participants disagree with the statement while only 14, 2% agree with it. It can therefore be concluded that most participants do not like Science programmes on TV.*

**Statement 40:** *Mathematics games are for boys.* This statement was negatively stated and it aimed to find out the opinion of participants in terms of Mathematic games and gender preference. *The result suggests that 77% of the participants agree and 23% disagree with the statement. It can therefore be concluded that Mathematics games are regarded as masculine games.*

#### **4.4.6 Tinkering activities.**

**Statement 41:** *During my childhood I was exposed to playing counting games.* The aim of the statement was to finding out whether participants were exposed to playing counting games or not. *A great number of participants 91, 3% disagree with the statement. It can therefore be concluded that the participants were not exposed to games that involve counting.*

**Statement 42:** *We never play mental challenging games at home.* This statement was negative and the expectation was that most of the participants would disagree with it. *Nevertheless a great number of participants 86% agree with it. It can therefore be*

concluded that the majority of participants were not exposed to mentally challenging games.

**Statement 43:** *During my childhood I was not exposed to playing with toys.* The statement was stated negatively and the expectation was that most participants would disagree with it, because in general most kids are playing with toys. Nevertheless, the result suggests that 74% agree and 26% disagree. It can therefore be concluded that the majority of the participants were not exposed to playing with toys.

**Statement 44:** *Our science classroom is decorated with nice challenging posters.* This statement was stated positive and the normal expectation is that the participants would agree with it. The result suggests that 77, 7% of the participants agree with it. It can therefore be concluded that most of the science classes are decorated with nice science posters that are challenging.

**Statement 45:** *At home we play computer games that are mathematically related.* The statement aimed to find out if there was some degree of exposure to computer games that are mathematically related. *The result suggests that a high number of participants (98%) disagree with the statement.* It can therefore be concluded that most of the participants are not exposed to computer games that are mathematically related.

**Statement 46:** *The teacher use practical activities to stimulate us in Science.* This statement was positive and it aimed to find out whether teachers used practical activities to stimulate learners. *A large number of participants 75% disagree with the statement and 24% agree with it.* This suggests that most teachers do not use practical activities to stimulate learners' interest.

**Statement 47:** *One or both my parents have a career in Science related fields.* This statement aimed to find out if any of the parents had a career in the science related fields. *The result reveals a high percentage (98, 5%) of participants that disagree with the statement.* It can therefore be concluded that the parents of the respondents do not have careers in the Science related fields.

**Statement 48:** *My parents never buy me any Mathematics books to read.* This statement was negative and it aimed to find out if the participants are provided by parents with reading materials that are mathematically related or not. *The result reveals that 83% of the*

*participants agree with the statement.* It can therefore be concluded that the majority of the parents do not buy Mathematics books for their children to read.

**Statement 49:** *I have been to science fair many times.* This statement was stated positively and the expectation was that most participants would agree with it. The result suggests that around 99% of the participants disagree with the statement. It can therefore be concluded that most participants have not attended science fairs many times.

**Statement 50:** *I have never been to Science career orientation in my life.* The statement was stated negatively and the expectation was that the majority of the participants would disagree with it. *On the other have 78, 7% of the participants agree with the statement.* It can therefore be concluded that most of the participants have not attended Science career orientation.

#### **4.5 CONCLUSION**

In this chapter, the findings from the questionnaire have been presented. Section 4.3.2 to 4.3.6 presented the different topics assessed by the questionnaire. This chapter further discussed in detail the different topics covered by the questionnaire. Each statement was discussed and the Chi-squared values were listed. The next chapter discusses the conclusions derived from Chapter 4 and also provides possible recommendations.



# **CHAPTER 5**

## **SUMMARY, CONCLUSIONS**

### **AND POSSIBLE RECOMMENDATIONS**

#### **5.1 SUMMARY**

The aim of the study was to find out if there are socio-cultural factors that prevent the progress of girls in the fields of Science and Mathematics in Namibia (see section 1.1 to 1.4). The study was divided into the following five chapters:

Chapter 1: Introduction;

Chapter 2: Review of Literature;

Chapter 3: Research Methodology;

Chapter 4: Data Analysis; and

Chapter 5: Summary, conclusions and possible recommendations.

The following research questions were set:

#### **Main research question:**

Are there socio-cultural factors such as values, beliefs, experience and traditions that have negative impact on girls' perception and understating of Science and Mathematics in Namibia?

#### **Sub Questions:**

- What positive or negative influence do girls have about Science and Mathematics from parents and teachers?
- What cultural or traditional inheritable norms hinder girls' interest in Science and Mathematics?
- What positive/negative beliefs and self-image do girls have about Science and Mathematics?
- What are the attitudes of girls towards Science and Mathematics?
- What type of tinkering activities are girls exposed to and how do they influence them towards Mathematics and Science?

Conclusions are drawn from the literature review and the empirical research and possible recommendations are made with regard to each of the sub-questions mentioned above.

## **5.2 CONCLUSIONS**

### **5.2.1 What positive/negative influence do girls have from parents and teachers with regard to Mathematics and Science?**

From the literature in sections 2.1.1, 2.1.4, 2.2.4 and 2.2.5, various authors indicate that there are several influences emanating from parents and teachers with regard to the achievement of girls in Mathematics and Science such as:

- Low parental aspiration and expectation for girls to do well in Mathematics and Science negatively influence their performance. Van Leuven (2004:249) describes this as girls underestimating their ability, feeling less adequate and having lower expectation of success in Mathematics and Science compared to boys.
- The existence of family child rearing practices that are gender stereotyped where boys are brought up differently from girls. One example given is where parents will rather spend money on boys than on girls, this having a negative impact on the girls' interest.
- In some cultures, both teachers and parents contribute to the poor performance of girls in Mathematics and Science.
- Teachers have different expectations regarding existing knowledge in Mathematics and Science for boys and girls. This belief tends to justify the teachers asking more questions and giving more practical tasks to boys than girls. Such practices negatively influence the perceptions of girls about their abilities to perform well in these subjects. Braund and Driver (2005:77-79) attribute this behaviour of girls to bad experiences regarding practical work in the primary school that is transferred to the secondary school.
- A study by Chin and Kayalvizhi (2005:109) suggests that involving learners in practical work and giving them a task or responsibility in the investigation is a significant factor in promoting positive attitudes. Spender's studies in Lemmer (1994:

12) however show how teachers tend to favour boys over girls in Science practical work.

- Van Leuvan (2004:249) is of the opinion that many teachers unknowingly convey messages with the notion that girls are not as capable as boys in Mathematics and Science. Klein (2004:185), in a study done in Israel, reports that in science classes teachers initiate interactions more with boys than with girls and they present the former with more difficult and challenging questions than the latter. These behaviours of teachers may also arise from beliefs such as: girls are more passive than boys; girls are better behaved than boys and that the obedience of girls manifests in that they readily adapt to the instructions of teachers regarding how to learn. On the other hand, it is considered that boys are more independent in the way they study and that the behaviour of boys is characterised by more assertiveness, competitiveness and aggressiveness (Van Leuvan 2004: 185).
- Tai and Sadler (2001: 1018) are of the opinion that gender-insensitive pedagogy from teachers could retard both performance and persistence among girls in Science. They further claim that addressing the issue of female representation in science-related professions is not merely a recruitment issue, this process should begin as early as elementary school where the curiosity of students about the natural world should be encouraged and their intellect challenged. This process should continue on into high school where students begin to gain a greater appreciation for the variety of possibilities upon which they may focus their intellectual energy.
- David et al. (1996: 29-55) and Harding (1986:9-28) argue that the attitudes adopted by girls from parents, teachers, friends and society have a significant influence on their choice and performance in Mathematics and Science.” A study by Lawrenz and Veach (2005: 156) attributes the lack of support from parents in helping their children with complicated mathematical problems to: parents not having a career in Mathematics and Science; stereotypical treatment from parents and a lack of interest in the progress of their children.

From the empirical research in section 4.3.3.1 various statements from the questionnaire point towards the following conclusions:

- Teachers ask and give measuring tasks more to boys than to girls. These practices can reduce the interest of girls in the subject as they will regard themselves as less capable than boys. In statement 31, the majority of girls agree with the statement that it is normal for boys to perform better than girls in Mathematics. In statement 32 the results indicate that 48% of the girls do not believe that they can do better than boys in practical work. This behaviour of girls according to statement 33, 34 and 35 is enhanced by: boys teasing girls during practical work; boys dominating practical activities and unequal task distribution by teachers regarding practical activities.
- According to statement 2, girls are of the opinion that they are free to express their opinion in the Physical Science class. On the other hand, statement 3 reveals that there is an imbalance in the way Mathematics is presented to boys and girls.
- The results of the questionnaire indicate that 82% of the girls are of the opinion that their parents discourage them from taking up Mathematics as they prefer Commercial fields of study for their girls (see statement 4 and 9). Such expectations from parents could contribute negatively to the interest of the girls in careers in the fields of Mathematics and Science.
- The results for statement 8 indicate that 27, 4% of the girls are of the opinion that they were discouraged by teachers since primary school not to take up Science as a subject in future.
- Although the results for statement 7 indicate that 89, 5% of the participants claim that teachers in class help individual learners with Mathematical difficulties, the results for statement 10 indicate that there is little support from parents concerning girls that are struggling with Mathematical problems at home. This can be due to many factors such as the lack of interest of the parents in the performance of their children or poor mathematical knowledge on the part of the parents.

### **5.2.2 What cultural or traditional inheritable norms hinder girls' interest in Science and Mathematics?**

From the literature in Section 2.2.2 it can be deduced from the opinions of several authors that:

- Traditionally families believe that Mathematics and Science is a male subject. According to Lawrenz (2005: 157), these stereotypes and male dominated lifestyles can be eliminated if governments give parents the opportunity to learn about gender equity and the abilities of girls. She further claims that despite good intentions from governments to pass laws and bills, they do not change the views of society by providing the necessary information and training.
- It is considered that girls are not capable of doing Mathematics and Science because these subjects are too complicated for them.
- Gender stereo-typing in Mathematics and Science is more prevalent in Africa and Asia compared to Europe and America.
- Girls in Sub-Saharan Africa have a strong belief in culture and therefore they are mostly influenced by their cultural norms.
- Aspects such as inter-group ethnic and socio-economic or socio-cultural differences, manifesting in various gender-related norms, stereotypes and expectations are factors that are affecting girls.
- Due to strong cultural norms, girls in Africa tend to model the careers of their mothers and this influences their subject choice as most mothers do not have careers in Mathematics and Science.
- Traditional and cultural roles that are expected from girls are a major impediment to their achievement in Mathematics and Science. Women are expected to do household duties and this has an influence on the type of subjects they choose.
- Wiest (2001: 14) is of the opinion that people in the community need to realize that Mathematics is relevant to the lives and future of girls and that it is something that they are capable of doing.

- Authors like Nagel (1992: 63) and Maraire (1994:12) indicate culture as a major factor in the development of education; this is the way people see life and pre-suppose what is wrong and what is right for each gender to do. In this regard a study by Rosser (1994:49) stresses the fact that traditional practices can be influential factors in the academic achievement of a girl.

From the empirical research in section 4.3.4 the results of the questionnaire reveal the following:

- The results for statement 11 indicate that 53, 9% of the participants experience cultural and traditional restrictions regarding their involvement in Mathematics and Science. The results for statement 12 indicate that 81% of the participants are of the opinion that pursuing a scientific career is in conflict with what is expected in their culture.
- The results for statement 13 indicate that 66% of the participants agree that traditionally girls are regarded as less competent in Mathematics and Science than boys.
- According to statement 15, a high percentage (74, 5%) of the participants agrees that high achievement by boys in Mathematics and Science is regarded as more important than for girls.
- In many cultures there are pre-determined career fields that are allocated to the different genders, for example, girls should undertake commercial and household related fields while boys undertake the scientific and vocational fields of studies (see statement 17).

### **5.2.3 What positive/negative beliefs and self-image do girls have about Mathematics and Science?**

From the literature in Section 2.2.3 various authors suggest that there are negative beliefs and self images that contribute heavily towards the poor participation of girls in Mathematics and Science:

- Girls rank their intellectual ability in Mathematics and Science lower than that of boys, resulting in negative self concepts and beliefs. This underestimation of the ability of girls attributes to low perception of self-worth which in turn affects the achievement of girls in these fields (Seifert 2004:137-141). Seifert (2004: 137) refers to poor self-efficacy and poor self-worth as the main problems that contribute to poor achievement in Mathematics and Science.
- Beliefs stemming from cultures, traditions and religions are major factors that contribute to a person's self-image and character. Due to the fact that many traditions and cultures are opposed to girls doing Mathematics and Science, the self-confidence of the girls has become so low that they start believing that they are not capable of excelling in these subjects. Osborne, Simon and Collins (2003: 1054) attribute this lack of confidence to anxiety toward science, poor achievement in Science and the nature of the classroom environment where these girls find themselves. Seifert (2004: 137) refers to self-efficacy as a synonym for confidence; this is the pre-judgement of a girl's capability to perform a task at a specific required level of performance. Van Leuvan (2004: 249) says that "although there is a decrease in mathematics self-concept for all students in high school, the confidence of girls in their mathematics and science abilities declines much earlier and is much more pronounced."
- Girls feel less adequate and have lower expectations for success in Mathematics and Science compared to boys.
- Tai and Sadler (2001:1017) claim that girls have managed to receive degrees in many fields of studies but not so much in the fields of Science and Technology.

From the empirical research in section 4.3.5, the results of the questionnaires reveal the following:

- Many (72, 5%) of the girls who answered the questionnaire do not participate in Mathematics and Science with confidence (statement 21).
- On the other hand 63, 8% of the girls are of the opinion that they underestimate their ability to do Science (statement 22).

- Many of the girls who responded to the questionnaire believe that they have no future career in Mathematics and Science. The results for statement 24 indicate that 69% of the participants are not willing to do Science, while the results for statement 25 indicate that 53, 5% of the participants believe that it is an unusual practice for girls to do Science. The results for statement 26 indicate that 61% of the participants believe that they have no future with Mathematics.
- Girls are of the opinion that there are other fields of studies that are more women oriented than Mathematics and Science. In this regard, (statement 28) 73% of the participants will rather choose a commercial field of study that a scientific field of study.
- The results for statement 29 indicate that 87% of participants agree that Mathematics is too complicated for them. This can have a serious psychological impact on the ability of these girls to perform well in Mathematics. The picture that the majority of participants paint in their minds about Mathematics is that it is too complicated and this reduces their level of motivation to excel in the subject.

#### **5.2.4 What are the attitudes of girls towards Mathematics and Science?**

The literature mentioned in sections 2.1.1 and 2.2.5 shows that different authors have identified a variety of issues that affects or contributes to girls' negative attitudes:

- Girls under-estimate their Mathematics and Science competencies and this affects their attitudes towards the subject.
- Girls' attitudes are affected by the family stereotypical expectations where boys are expected to achieve, explore, take risks and work independently while girls are expected to only engage in safe play.
- Girls' attitudes are also affected by peers, family, and subject teachers that demand modest and inferior behaviour from girls.
- Most girls in Africa are culturally rooted and this has an influence on their attitudes because their culture puts pressure on their attitudes and the behaviour.
- Girls have negative attitudes about Mathematics and Science.



- Lack of support, positive influence and encouragement from friends, family and the community are factors that foster poor gender equitable perceptions, lower academic achievement, poor self-concept and all these lead to inferior and negative attitudes in girls towards Mathematics and Science.

From the empirical research in section 4.3.6, the results of the questionnaire reveal the following:

- Girls have an inferiority complex when it comes to Mathematics and Science; they think that they cannot do better than boys.
- Girls, when doing Science practical work, have an attitude that boys should do the difficult parts as well as the measurements and that tasks should not be shared equally.
- Science lessons are boring and uninteresting.
- Girls do not like Science programmes on TV.
- Girls do not like games that are mathematically oriented.

### **5.2.5 What type of tinkering activities are girls exposed to and how does that influence them towards Mathematics and Science?**

The literature in section 2.2.5 indicates that various authors have deliberated on several aspects regarding tinkering activities:

- Girls are not exposed to counting games during their childhood.
- Most girls are restricted to only certain activities in the house and on the playground.
- Traditional societies start channelling children into gender stereotypical activities even at primary school level. This type of stereotyped upbringing determines the type of toys parents buy for their children.
- Boys are exposed to more computer games and mathematical and science related games than girls. A study done by Colley and Comber (2003: 156-159) indicates that for their target group, approximately 54, 2% of girls have access to a computer and games at home compared to 82, 0% of boys.

- Practical work in class is not used to stimulate the curiosity of girls regarding Mathematics and Science.
- Wiest (2001: 14) indicates that parents should be effective role models to which children can turn to follow their example. Tait (1996: 749-751) notes that children whose parents have a high level of education tend to have high aspirations. This is mainly due to the influence that such parents have on their children.

From empirical research in section 4.3.6, the results indicate (statements 41 to 50) the following:

- Girls are not exposed to counting and mental challenging games during their childhood. Wiest (2001: 14) reports that high school girls are more likely to say that they do not take mathematics courses because they are advised that they do not need them or because they dislike the subject matter.
- Girls are prohibited from playing with certain toys as this is regarded as for boys only.
- Science classes are decorated with posters that could provoke interest and serve as a motivation for the girls in Science.
- Practical work in the class is not used to stimulate learners' interest in the subject.
- Parents are role models for their children, yet there are very few parents that have a career in the Mathematics and Science fields. Therefore children do not have any one in the family to model.
- Parents do not buy Mathematics and Science-related books for their children to read in order to stimulate Mathematics and Science-related interest.
- Generally learners do not attend Science-fairs or Mathematics and Science career guidance programmes.

### **5.3 SUMMARY REGARDING CONCLUSIONS**

The findings from both the literature study and the empirical research indicate that many factors from the socio-cultural, traditional and environmental backgrounds of girls negatively influence the participation of girls in Mathematics and Science. The influence of

parents and teachers, cultural and traditional norms, positive beliefs and self-image as well as the attitudes of girls in this regard should not be underestimated.

Some girls show a strong association between their future career ambition and the careers of their parents, especially those of their mothers. This could be a good motivational factor but only if the parents were involved in the fields of Mathematics and Science. On the point of family support and role models most girls have suggested that there are very few parents who motivate their girls to become involved in the fields of Mathematics and Science. The findings indicate some mentoring and influence from parents and teachers as helping factors. It is, however, evident that more than organisational and cultural changes are needed. Changes in this regard should be initiated by parents, teachers, legislators and the education authorities in order to positively shape their practice, knowledge, ability and will. At school level the stakeholders should construct and implement strategies of intervention that nullify the negative perceptions that girls have regarding the fields of Mathematics and Science and by challenging negative practices in this regard.

The lack of ability, drive, and potential of girls regarding the fields of Mathematics and Science originate in the psychological, cultural and traditional influences that girls experience from their childhood. Factors that contribute in this regard are negative traditional beliefs, values and norms about the role of women in society. The academic culture that girls experience should be such that culture and traditions would influence them to start achieving and prospering in the fields of Mathematics and Science. By providing girls with the necessary support, motivation and opportunities regarding the fields of Mathematics and Science, girls could be empowered to persist, persevere and overcome the challenges posted by negative cultural and traditional values and beliefs.

A significant correlation between self-concept, motivation and positive attitudes as factors that could influence increased participation in the fields of Mathematics and Science is evident from the findings. Information sessions for parents and in-service programmes should be developed in order to enhance these affective factors. The education authorities

should cooperate with other authorities such as those responsible for gender equality and child welfare.

The preceding discussion of socio-cultural factors affecting the progress of girls in Mathematics and Science related fields of studies in Namibia, Africa as well as internationally suggest that these factors are very complex and deeply rooted. Therefore a proactive policy approach involving state, institutional and community support systems should be used to create a variety of gender-sensitive educational programmes designed to reduce gender imbalances and foster more constructive participation of women in the fields of Mathematics and Science.

#### **5. 4 POSSIBLE RECOMMENDATIONS**

In the learning situation it is a common occurrence that some students perform well while others do not perform up to expectation. This can usually be attributed to differences in the student's perceptions, interest, attitudes, motivation, self-concept as well as to different cultural and environmental factors. For a particular student, perceptions, interest, attitudes, motivation and self-concept are affective (psychological) factors which originate from and correlate to the cultural and environmental influences that are prevalent.

Against the background of the research questions and the findings in the previous chapter, the recommendations that follow focus on gender issues, particularly the influence of culture and traditions, beliefs, attitudes and the perceptions of girls about themselves concerning Mathematics and Science.

##### **5.4.1 Culture and traditions**

The following factors regarding culture and traditions especially in Namibia were revealed by the study as influencing girls in their interest and achievement in Mathematics and Science:

- The upbringing of girls is such that they should be submissive to men.
- Women are in general regarded as inferior to men.

- It is considered that girls should not become involved in complicated activities and games that involve Mathematics and Science.
- Girls are made to believe that the fields of Mathematics and Science are exclusively the domain of boys.
- Peer pressure at school level exists that has a negative effect on the participation of girls in the fields of Mathematics and Science.
- Traditionally tutorial matter and teaching practices are not conducive to gender equality.
- Some cultural norms go to the extent of having women believe that their purpose is to give birth and take care of the kids, while the man is the head of the family and should go to work to provide for the family.

### ***Possible recommendations***

There should be a concerted effort by the educational authorities to positively influence traditions and cultural practices in order to empower women and to incorporate democracy and gender equality. Girls must be given freedom to develop into scientists, engineers and engage in other Mathematics and Science-related fields. Gender equality should be included in the general curriculum at all levels. Parents, especially mothers, should be informed in this regard and could be engaged in the role of tutoring, encouraging and influencing young girl's to become positive about the fields of Mathematics and Science and gender equality.

### **5.4.2 Beliefs**

Approximately 51% of the girls who responded to the questionnaire are of the opinion that both sexes can perform equally in Mathematics and Science. This finding is however, contradictory to their opinions about whether they themselves would engage in Mathematics and Science now or in future. Their responses are overwhelmingly opposed to the idea of them doing Mathematics and Science as their major subject at tertiary level. This implies that although many girls believe that they would be able to perform

successfully in these two fields of study, they themselves have no interest in doing so.

Other beliefs from the study that are worth noting are:

- (a) From a cultural perspective women are inferior to men.
- (b) Girls believe they will not perform well in Mathematics and Science.
- (c) Girls believe that they are intellectually less capable than boys.
- (d) Girls are of the opinion that there are other interesting fields of study that are more appropriate than Mathematics and Science for girls.

### ***Possible recommendations***

Educational authorities should arrange information sessions for parents and in-service training sessions for teachers to inform them about the different developmental stages and suggest methods and techniques that could be used during the different stages to instil positive beliefs in girls regarding Mathematics and Science.

This could empower parents and teachers to inculcate positive beliefs in girls towards Mathematics and Science. Parents can do this through exposing their girls at an early age to Mathematics and Science related games and toys. Teachers can do this by making Mathematics and Science fun, interesting, challenging and easy to learn in class. Parents and teachers could be instrumental in freeing the girls from some of the binding cultural beliefs that do not support the freedom of women and gender equality.

### **5.4.3 Attitudes**

All learners develop attitudes towards a subject or a field of study which may influence their ability to perform in the subject or field of study. The attitude of learners towards a particular subject, whether it is favourable or unfavourable, stems mainly from the experiences that they have with the subject, their background and the traditional and cultural influences that impact on them (Mwamwenda 2005:183).

In this study the result of the investigation suggests that 71% of the girls have developed negative attitudes towards Mathematics and Science. These negative attitudes are the result

of the way they are brought up and the environment in which they grow up. In general, it can be said that the attitudes of learners resemble the attitudes of their parents. In many cases, it could thus be the negative attitudes of the parents towards the involvement of girls in Mathematics or Science that lead to their lack of motivation and poor interest regarding these fields of study.

### ***Possible recommendations***

According to Mwamwenda (2005:48), during the early childhood children should be engaged in a variety of physical activities in order to develop and consolidate their motor and intellectual skills. It is thus recommended that educational authorities should arrange information sessions for parents and in-service training sessions for teachers to inform them about how children between the ages of 2 to 12 years can be exposed to Mathematical and Science related activities and games to develop their intellectual development, and to develop positive attitudes towards Mathematics and Science. It is further recommended that parents should be encouraged to send their children to attend pre-school in order to prepare them regarding reading, writing and arithmetic and to expose them to a variety of fields of study. Parents and teachers should be informed about ways to instil in children the attitude that Mathematics and Science are manageable. In this way, a positive attitude in girls towards Mathematics and Science could be imparted at an early age.

#### **5.4.4 Girls' perceptions about themselves concerning Mathematics and Science**

Girls generally do not regard themselves as people who would be interested or would excel in Mathematics and Science. They perceive Mathematics and Science as difficult, too complicated and a masculine subject. They regard themselves as commercial people that must do subjects like Business Studies, Accounting or Administrative Studies. Most of the perceptions stem from the cultural-traditional beliefs that divide careers along gender lines as being either masculine or feminine. Although to a large extent development, industrialisation and democracy have created equal opportunities for both males and females, it remains a problem for girls to enter into certain streams of careers due to the way they perceive themselves.

### ***Possible Recommendations***

Educational authorities should include the following aspects in the general curriculum (including in-service training for teachers and information sessions for parents in this regard):

- Gender equality.
- How Mathematics and Science can be made easy.
- Career guidance which is not gender specific.
- The need for the country that both genders become more involved in the fields of Mathematics and Science.
- The notion that both genders have equal abilities regarding Mathematics and Science.
- The notion that especially girls can change their disempowering perceptions about themselves to empowering ones.

This could help girls to break free from the mental block that hinders their progress in Mathematics and Science. Girls should be encouraged to participate more freely in classroom activities by initiating questions, taking leading roles in practical sessions and by being more assertive when making statements. This could be augmented by organising career guidance sessions which are not gender specific in order to encourage girls to attend.

### **5.5 LIMITATIONS OF THE PRESENT STUDY.**

Because of the limited amount of research literature available with regard to the situation in Namibia, general literature had to be used and the information transferred to the particular research questions that were considered.

The study uses an attitude scale which implies that the researcher can never be sure of the degree to which the girls' responses reflect their true attitudes. A high percentage (86%) of the questionnaires was returned. This is mainly due to the design of the questionnaire that was relatively short, easy to understand and easy to complete. The researcher also followed up the initial distribution of questionnaires by appeals in all schools that the questionnaires



should be within a reasonable period of time. However, the results cannot be generalised to the whole country because of the limited scope of the research sample. This was due to time and financial constraints.

The focus of the study is only on the opinions of girls without considering the opinions of other stake holders such as boys, parents and teachers in this regard.

## **5. 6 RECOMMENDATIONS FOR FUTURE RESEACH**

Further research is needed in the following areas:

- Psychological factors influencing girls' perceptions on Mathematics and Science.
- The role of parental influence in their children's educational choice.
- The positive value of culture in the upbringing of a child towards Mathematics and Science.
- The relationship between effective domain and self concept.
- Does poverty have any influence on girls' participation in Mathematics and Science?

## **5.7 CONCLUDING REMARK**

The aim of this research was to investigate and explain the influence that the socio-cultural background may have on the perceptions and participation of girls in the fields of Mathematics and Science. The research findings of this study indicate that the aim of the study was achieved. It is hoped that Namibian parents, teachers and learners will use these findings to positively influence on the perception and participation of girls in the fields of Mathematics and Science. It is further hoped that the findings and recommendations presented above will help teachers and parents to not only understand the problem, but also to assist them in addressing the problem accordingly.

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## Appendix A

### Questionnaire

- (1) The following 50 statements represent opinions, feelings and perceptions, your agreement or disagreement will be determined on the basis of your particular beliefs or how you feel about a particular statement.
- (2) Kindly read the statement and register your position with an X in the appropriate box by using a pencil. Please indicate what you believe, rather than what you think it should be.
- (3) Please remember to enter your age, grade and home language.
- (4) Do not write your name.
- (5) Key: **SA**= Strongly Agree, **A**= Agree, **UD**= Undecided, **DA**= Disagree and **SDA**= Strongly disagree

(6) Example:

Statement	SA	A	UD	DA	SDA
1) In my Mathematics class girls <b>do</b> the class room <b>sweeping</b> .	X				

- a) If you think the Mathematics teacher always asks girls to sweep the classroom, then you make an X at **SA**.
- b) If you think this teacher almost never asks girls to sweep the classroom you make an X at **SDA**
- c) Or you can choose **A** or **UD** or **DA** if this seems like a more accurate answer.
- d) If you want to change your answer erase it and make a new X at your new cho

**Fill in the following:**

**Grade** \_\_\_\_\_ **Home Language** \_\_\_\_\_

**Age** \_\_\_\_\_ **ID number 111**

For the next 10 statements you will answer questions on **Teacher and Parents**

Statement. No	Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree	Non-response
1) The Science teacher asks boys questions more often than girls.						
2) I am <b>free to express</b> my opinion in the Physical Science class.						
3) In my school boys and girls learn Mathematics <b>equally</b> .						
4) My parents <b>discourage</b> me to take Mathematics as my major in the future.						
5) Boys <b>discouraged</b> girls during Science practical work.						
6) My Mathematics teacher <b>punishes</b> us for not knowing the correct answer.						
7) My Science teacher <b>helps each individual</b> learner with Science problems.						
8) From primary school years I was <b>discouraged</b> by teachers to do Science.						
9) My parents <b>advise</b> me to take commercial subjects rather than Science.						
10) I <b>get support</b> from my parents on Mathematics problems that prove difficult.						

For the following next 10 statements you will answer questions on Culture and Tradition.

Statement. No	Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree	Non-response
11) In my culture women are <b>allowed</b> to become scientists.						
12) Some <b>cultural beliefs</b> in my community are in <b>conflict</b> with the opinion that girls can do Science.						
13) In my tradition girls are regarded as <b>competent/capable</b> in Science as boys.						
14) In my culture girls are <b>free to do</b> Mathematics.						
15) According to my tradition, it is <b>more important</b> for boys to achieve in Science than for girls.						
16) I find it <b>worthless</b> to work hard in Science because my future is not there.						
17) According to my culture, girls are <b>expected</b> to take subjects that are related to domestic science.						
18) My tradition <b>expects</b> boys and girls to have <b>equal</b> job opportunities in the Science field.						
19) In my culture housework is a <b>normal activity</b> for girls.						
20) My traditional leaders <b>motivate</b> girls to do Mathematics.						

For the following 10 statements you will answer questions on beliefs and self-image.

Statement. No	Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree	Non- response
21) I do Science with <b><u>confidence</u></b> .						
22) I <b><u>underestimate</u></b> my <b><u>ability</u></b> to do Science						
23) I have <b><u>no future</u></b> with Mathematics.						
24) Girls in my school are <b><u>willing</u></b> to do Science.						
25) I <b><u>believe</u></b> that it is an unusual practice for girls to do Science.						
26) Mathematics is very <b><u>important</u></b> for my future career.						
27) Boys and girls have <b><u>equal</u></b> Mathematical abilities.						
28) If I have a <b><u>choice</u></b> between Scientific studies and Commercial studies, I would do commercial studies.						
29) Mathematics is <b><u>too complicated</u></b> for my understanding.						
30) I think I can <b><u>contribute</u></b> to solving complex Mathematical problems in class.						

For the next 10 statements you will answer questions on male domain and girls' attitudes.

Statement. No	Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree	Non-response
31) It is quite normal for boys to perform <b>better</b> than girls in Mathematics.						
32) It is possible for girls to perform <b>better</b> than boys in Science practical tests.						
33) When a girl outperforms the whole class in a Science test, she will be <b>teased</b> by the class mates.						
34) Whenever a measurement has to be done in Science practical work, a boy <b>does</b> it.						
35) In Science practical work boys and girls <b>share</b> tasks equally.						
36) Science lessons are <b>boring</b> .						
37) I <b>enjoy</b> reading Science related publications						
38) I think Mathematics is an <b>easy</b> Subject to understand.						
39) I <b>like</b> Science programmes on TV.						
40) <b>Mathematical games</b> are for boys.						

For the following 10 statements you will answer questions on tinkering activities.

Statement. No	Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree	Non- response
41) During my childhood I was <b>exposed</b> to playing counting games.						
42) We <b>never</b> play mental challenging games at home.						
43) During my childhood I was <b>not exposed</b> to playing with toys.						
44) Our Science classroom is <b>decorated</b> with nice challenging posters.						
45) At home we <b>play computer games</b> that are Mathematically related.						
46) The teacher uses practical activities to <b>stimulate</b> us in Science.						
47) One or both my parents have a <b>career</b> in Science related fields.						
48) My parents <b>never</b> buy me any Mathematics related books to read.						
49) I in my life have <b>never</b> been to science <b>career orientation</b> .						
50) I have been to Science <b>fairs</b> many times						



**APPENDIX B**

The Principal

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

**Request for research authority**

Dear Principal

Topic: Socio-cultural factors influencing the progress of girls in the field of Mathematics and Science in Namibia. I am a registered Master's of Education student at the University of South Africa. I am conducting an important research on the above mentioned topic.

I hereby request your permission to conduct research at your school.

The findings will be used for the research purpose only. The confidentiality of participants will be highly kept.

Yours truly,

Mr C Twaundu

## Appendix C

### Request for permission to conduct research in schools

Collin Tuaundu

PO Box 25717

Windhoek

Namibia

Student nr: 33584303

Cell nr: 0812747800

Ms Tjikuwa

The Director of Education

Khomas Region

Windhoek

Dear Madam

I m a student at the University of South Africa (UNISA), I m enrolled for the course Master's in Education (Natural Science Education). My research topic is: **Socio-cultural factors that influence girls from progressing in the field of Mathematics and Science in Namibia.**

To complete the requirements for this degree I need to do research on the above mentioned topic. This requires co-operation from parents, learners, school managers and the Ministry of education as well. I hereby ask for permission from the director's office to conduct my research in five schools in Windhoek of which I cannot name for ethical reasons. I am willing to share the outcome of my study with the Ministry of Education if they require it.

Let me thank you in advance for your anticipated favourable response. You are welcome to contact my supervisor Prof Potgieter on Tel: + 27 12 429 4393 (w). His e-mail address is Potgic@unisa.ac.za.

Your sincerely,

C Tuaundu

**APPENDIX D**  
**Letter to the parents**

From Mr C Tuaundu  
P O Box 25717  
Windhoek  
Namibia

**RE: Permission for your child to take part in a research study**

**Topic: Socio-cultural factors that prevent girls to progress in the field of Mathematics and Science in Namibia.**

Dear Parent

I m a student at the University of South Africa (UNISA) doing a Master’s degree in Education and I hereby ask for permission to use your child.....in Grade..... as one of the participants who will act as a respondent. The child anonymity remains a priority and any finding will solely be used for academic purposes only.

Should you accept this request mark **Yes** and if you decline mark **No** in the appropriate block below with your signature below the box and send this paper with your child back to school.

<b><u>YES</u></b>	
<b><u>NO</u></b>	

Signature.....

Thank you in advance for your valuable contribution.



REPUBLIC OF NAMIBIA

MINISTRY OF EDUCATION  
KHOMAS REGION

Tel: (09 264 61) 2939411  
Fax: (09 264 61) 231367  
Enquiries: T.L. Shivute

Private Bag 13236  
Windhoek

File No.: 12/2/6/1

November 9, 2007

Mr Collin Tuaundu  
P.O. Box 25717  
WINDHOEK

Dear Collin

**SOCIO-CULTURAL FACTORS THAT PREVENT GIRLS IN NAMIBIA FROM  
PROGRESSING IN THE FIELD OF SCIENCE AND MATHEMATICS**

Your request for a research in our schools on the abovementioned topic has reference.

You are hereby given permission to visit five schools of your choice in the Khomas Education Region with the following conditions:

- a) arrangements have to be made with the Principal before hand
- b) teachers/learners who will be involved should do so voluntarily
- c) the interview should not disrupt the school programme/classes
- d) a copy of the final report should be provided to the Khomas Education Region



**Appendix F**

**Permission to conduct pilot study**

The Principal

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

Dear Principal

**Request for permission to conduct a pilot study**

I am employed by the Ministry of Education in Namibia, and I am currently registered with University of South Africa for the Degree of Master’s of Education (MeD). I am expected to undertake research as part of the requirement for the degree of Masters of Education.

The purpose of the study is to find out what social cultural factors prevent girls in Namibia to progress in the field of Science and Mathematics.

I am writing to seek permission to distribute questionnaires to your female learners for the purpose of conducting a pilot study.

Please find attached copies of the provisional questionnaire for your perusal.

Your favourable consideration will be appreciated.

Yours sincerely

C. Tuaundu

