RELATIONSHIP BETWEEN SELF EFFICACY AND MATHEMATICS PERFORMANCE AMONG ZAMBIAN GRADE 11 PUPILS IN LUSAKA URBAN

By

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A dissertation submitted to the University of Zambia in partial fulfillment of the requirements of the degree of masters of education (educational psychology)

THE UNIVERSITY OF ZAMBIA

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DECLARATION

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This dissertation by CHIMFWEMBE GERTRUDE is approved as fulfilling part of the requirement for the award of the Degree of Masters of Education (Educational Psychology) by the University of Zambia.

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DEDICATION

This work is dedicated to my family for its immeasurable support and contribution towards my whole being.
ABSTRACT

This study, on the relationship between self efficacy and mathematics performance among grade eleven pupils was conducted in three high schools in Lusaka urban, Lusaka province, Zambia. The study concentrated on investigating the relationship between self efficacy and mathematics performance. The aim of undertaking the study was because School certificate (SC) and general certificate examination (GCE) results in Zambia show desperately poor performance in mathematics. For example, the 2000 SC and GCE mathematics results showed that more than half of the pupils who sat for mathematics examinations failed and this situation poses totally unacceptable levels of pupil performance (Haambokoma, et al; 2002:101).

Leading research objectives were:

To investigate if pupils at high school hold positive beliefs concerning their own self efficacy in mathematics; to find out if there is a difference between higher and lower achievers in terms of mathematical self efficacy and to investigate if there is a significant association between pupils' level of mathematical self efficacy and their performance in mathematics.

In this study, 81 grade eleven pupils were sampled in three high schools in Lusaka urban. Both quantitative and qualitative methods were used. Data collection included pupils completing the questionnaires, writing a test and responding to a focus group discussion, as well as oral interviews with three
mathematics teachers, three heads of departments, a school manager and a mathematics standards officer.

The study revealed that:

There is a variation in the level of self efficacy in the pupils with a good number of pupils having a medium level of positive mathematical self efficacy. There is a significant difference between higher and lower achievers.

There is a positive correlation. A positive correlation indicated a significant relationship between pupils' performance in the selected five topics and their mathematical self efficacy. However, the teachers interviewed were of the view that there is no relationship. They pointed out that culture, teacher training curriculum and errors in some recommended Zambian textbooks are the main factors leading to a no relationship between mathematics self efficacy and pupil performance. But a standards officer (mathematics) said that there is a relationship between self efficacy and mathematics performance.

Based on the above noted findings of the study recommended that:

The Ministry of Education should ensure that Society is sensitized on the importance of inculcating positive mathematics self efficacy beliefs in the children. This can be done by exposing pupils to live or symbolic role models, performance exposure, self instructed performance and performance sensitization (a process through which aversive behaviour is paired with pleasant or relaxing experience), histories of past failures should be narrated
to children. Furthermore pupils should be exposed to symbolic exposures such as creating environments which are similar to examination atmospheres. This will allow children to practice in dealing with stress. Techniques such as relaxation techniques should also be made available to pupils.

The Zambia Association of Mathematics Educators (ZAME) should educate its teachers and other stakeholders in mathematics to stop finger-pointing and running away from the problem of poor performance of pupils in mathematics. Instead, teachers and other stakeholders should aim at instilling positive mathematical self-efficacy in their pupils. What should be born in their minds is that, pupils' self-efficacy beliefs towards mathematics teaching and learning play an important role in national and individual development.

Curriculum Development Centre (CDC) should design a curriculum that has emphasis on the three domains namely, cognitive, psychomotor and affective. Currently, the mathematics curriculum puts less emphasis on the affective part of learning.
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CHAPTER ONE
INTRODUCTION

1.1 Background

This chapter contextualizes the problem statement and the background information pertaining to underperformance in mathematics at national examinations and its relationship to mathematics self efficacy in Zambia. It also presents the aim and objectives of the study and operationally defines the terms that are used.

Mathematics is a subject in which learners have generally performed poorly. In national examinations, learners have performed most poorly in mathematics as indicated in the ministry of education policy document in which the government has shown concern on this state of affairs. MOE (1996:52, 54) says that,

The overall unsatisfactory performance in school certificate examination is attributed, in a large measure, to poor performance in mathematics and science. This situation requires urgent attention and major interventions. The pupils themselves and the country as a whole cannot sustain a continuation of unsatisfactory performance in mathematics and science and subsequent impairment of the national potential for technological development.

Furthermore, Tambulukani, et al (2004:6) says that

Innumeracy levels have remained very high as reported by the national assessment report of 2001, which put innumeracy at 72.3%.

Additionally, Haambokoma, et al (2002:102). analysed the school certificate (SC) and general certificate of examination (GCE) results for Luapula (the province with the highest national pass-rate for the year 2000) and North-
western (the province with the lowest pass-rate for the same year). From 24,977 (17,764 female and 42,741 male) candidates who sat for mathematics examination the whole country, 46.5% male failed and 68.6% female failed. Thus 55.7% of the candidates failed country wide. Thus of the total number of 1,879 (1,161 male and 718 female) candidates from Luapula province 32.3% male and 46.6% female candidates failed the examinations in mathematics for this particular year. Giving 38.2% failure rate for Luapula alone and yet it was the highest on general performance pass-rate. Taking the lowest North western province as another case study, 2,292 (1,386 male and 906 female) candidates sat for the national exams in maths. Of the total number 68.8% male failed while, 71% female failed, giving a total provincial failure rate of 69.7%.

Success in mathematics involves more than innate or natural talent, with attitudes, aptitude, prior experiences, vicarious experience, social persuasion, physiological and emotional state as well as personal background playing a major role. Components of affect are of central importance to influencing pupils’ disposition to learn. The responsibility for lack of progress of low achieving pupils rests as much with the affective, psychomotor factors as cognitive or personal environmental factors. However, while cognitive factors such as expectations, and classroom behaviours such as effort and persistence have influenced mathematics achievement in school, affective factors in school have been undervalued in their contribution to achievement. So far very few studies have been conducted to find out the kinds of perceptions and attitudes of
pupils towards mathematics (for example, Mulendema, 2007; Makubalo, 2005; Sulmiman; 2004 and Munsaka 2000).

1.2 Statement of the problem

Poor performance by high school leavers in mathematics is worrying to the government, pupils and other stakeholders. In national examinations, learners have performed most poorly in mathematics as indicated in the Ministry of Education policy document in which the government has shown concern on this state of affairs (MOE 1996:52, 54).

Various strategies have been implemented such as In-service Education Training (INSET), Demonstrate, Observe, Discuss and Implement (DODI), but their impact has not yet been felt because pupil performance in mathematics continues to be poor. Therefore, there is need to investigate pupil’s mathematics self efficacy in relation to performance as a means of improving the situation.

1.3 Purpose of the Study

School certificate and general certificate examination results in Zambia show desperately poor performance in mathematics. For example the 2000 school certificate (SC) and general certificate examination (GCE) mathematics results show that more than half of the pupils who sat for mathematics examinations failed and this situation poses totally unacceptable levels of pupil performance (Haambokoma, et al; 2002:101). Since that time, a number of studies have been
carried out (For example, Mulendema, 2007; Makubalo, 2005; Sulmiman; 2004 and Munsaka 2000). But these studies focused on anxiety, attitudes, perceptions and self concept. There is no published research known to the researcher that has been conducted to find out whether pupils themselves are mathematically self efficant.

Secondly, from the literature reviewed on Zambia as shown in chapter two, there is an information gap in this area. Therefore, in order to fill the gap in existing literature, the present study sought to investigate the relationship between self efficacy and pupil performance.

1.4 Objectives

The objectives of the study were as follows:

- To investigate if pupils at high school hold positive beliefs concerning their own self efficacy in mathematics.
- To find out if there is a difference between higher and lower achievers in terms of mathematics self efficacy.
- To investigate if there is a significant association between pupils’ level of mathematics self efficacy and their performance in mathematics.
1.5 Research Questions

The research questions were as follows:

- Do pupils at high school hold positive beliefs concerning their own self efficacy in mathematics?
- Is there a difference between higher and low achievers in terms of mathematics self efficacy?
- Do significant associations exist between pupils’ level of mathematics self efficacy and their performance in mathematics?

1.6 Significance of the Study

There are a number of reasons why this study is significant. Firstly findings of this study are likely to influence teachers of mathematics and learners in their perception and attitude towards teaching and learning of mathematics. Many grade twelve school leavers avoid taking up courses that utilize mathematics or have a mathematical component. This could be due to lack of mathematical self efficacy and not knowing how to learn and construct mathematics. The learning and construction of mathematical understanding depend partially on the learner’s self efficacy beliefs.

The findings of this study may help mathematic educators to apply approaches that instil into learners positive beliefs towards mathematics. What should be born in mind is that, pupils’ self efficacy beliefs towards mathematics teaching and learning play an important role in mathematics education.
The results could also be used by the Ministry of Education in policy making and by the Curriculum Development Centre (CDC) for assessment and evaluation purposes. Currently, the maths curriculum puts less emphasis on the affective part of learning. The research findings may therefore enable this curriculum development office (CDO) to appreciate the importance of developing positive mathematics self efficacy beliefs among learners.

Lastly, the findings of this study will contribute to the existing mathematics literature base.

1.7 Theoretical Framework

The study was guided by the self efficacy concept. Self efficacy is grounded in a large theoretical framework known as social cognitive theory. This theory postulates that human achievement depends on interactions between ones behaviours, personal factors (for example, thoughts, beliefs), and environmental conditions (Bandura, 1986, 1997) cited by (Fours, 2009). Pupils obtain information to appraise their self efficacy from their past performance, vicarious experience, persuasion and encouragements they receive from others and their physiological and emotional reactions. Self efficacy has influence on choice of tasks, effort, persistence, resilience and achievement. It is useful to the current study in that understanding of mathematics, acquiring of mathematical understanding, solving of mathematical problems and subsequently good performance, depend partly on the belief that one is capable of constructing
mathematical formulae, understanding mathematics, acquiring mathematics understanding and solving of mathematical problems. Another factor of significance is viewing mathematics as an expanding field of human invention which is dynamic and problem-driven, structured, and unchanging body of knowledge. Lastly, mathematics should be viewed as a collection of procedures, facts and skills.

Success in mathematics depends on one's resilience, effort and persistence. Efficacy to perform better in mathematics depends on the pupil's past performance and the experiences s/he has undergone influence from others as well as her/his physiological reactions. It also depends on one's behaviour, personal factors and the environment. Therefore, in order to attain the objectives, find methods as well as in analysing and discussing the findings of the study, the concept of efficacy was useful as reference.

1.8 Operational Definition of Terms

In this research the meaning of words are given as follows:

Mathematics Self efficacy: It is the "I can" or "I cannot belief" that one can understand mathematics, acquire mathematics understanding and solve mathematical problems effectively.

Emotional state refers to the mood one is when performing an activity, such as feeling anxious.
CHAPTER TWO
LITERATURE REVIEW

2.0 Introduction

This chapter presents various types of research that have been done in relation to the current study. It presents research from published and unpublished materials. It looks at the major findings, the methodologies used and the conclusions of these findings. This literature review is presented as follows: definition and description of mathematical self efficacy, mathematics positive self efficacy beliefs, the differences between higher and low achievers in terms of mathematical self efficacy, relationship between mathematical self efficacy and performance in mathematics. Thereafter, a conclusion is given.

2.1 Literature on the Definition and Description of Self-Efficacy

Self-efficacy, also called perceived ability, refers to the confidence people have in their abilities for success in a given task. It is a judgement of ones capabilities. It is an "I can" or "I cannot" belief whose judgement depends on the effective use of self regulatory strategies and motivation (Bandura, 1997) cited by Witt-Rosse (2003).

Four factors determine self efficacy: enactive mastery experience, vicarious experience, verbal persuasion, physiological and emotional states (Bandura, 1986, 1997). The most influential of these factors is enactive mastery
experience. Information gathered from success or failure in past situations is then internalized. Past successes raise self efficacy and repeated failures lower it, which indicate to individuals their levels of capability.

In a vicarious experience, pupils compare themselves to peers whom they perceive are similar in ability and intelligence to themselves. Watching peers succeed raises observer self efficacy and seeing them fail lowers it. Exposure to multiple successful role models helps increase self efficacy in observers.

Adolescents will often judge their level of self efficacy through vicarious experiences, most notably modelling, which has been defined as the behavioural, cognitive and affective change resulting from observing other individuals perform a behaviour (Pintrich and Schunk, 2002) cited in Pajares and Urdan (2006).

Modelling is one of the most important ways to promote learning and self efficacy. The impact of a model on self efficacy beliefs will be strongest when observers believe that they can be successful if they follow the model’s behaviours and if they believe they are similar to the model in terms of age, ability, and gender (Schunk, 1987, Schunk, Hanson and Cox, 1987) cited in Pajares and Urdan (2006). It should be noted that models can be different types of individuals (for example, peers and adults), can take various forms (for example, live models and symbolic models), and can be used in different
formats (for example, coping and mastery models). Coping models, who display confidence and adaptation when confronting errors in learning are significantly more effective in sustaining student's perceptions of self efficacy than are mastery models who perform without errors (Zimmerman and Kitsants, 2002).

Verbal persuasion tries to convince pupils, who may doubt their capabilities, that they possess the skills needed for success at a given task. In education, verbal persuasion delivered by teachers often takes the form of verbal feedback, evaluation, and encouragement.

Adolescents do not have to act or engage in an activity to learn or to feel confident in their abilities. Rather, their sense of efficacy can be either enhanced or lowered by the behaviours and/or feedback given by important individuals in their lives such as parents, teachers, counsellors and peers. Social agents promote positive perceptions of efficacy in adolescents by either using various forms of verbal persuasion (for example, encouragement, progress feedback) or by modelling specific strategies, behaviours or thoughts.

Persuasion must be realistic, sincere, and from a credible source; otherwise it can negatively affect pupil self efficacy beliefs. Although encouraging comments (for example, I know you can do it) and reassuring statements from a parent or teacher (for example, you will do better next time) may help struggling students sustain their motivation in the short term; the effects of such statements
will be short-lived if the student is consistently unable to attain perceived successes. However, social agents can play a key role in cultivating more long-lasting changes in adolescents' self efficacy beliefs for academic tasks by providing them with feedback linking performance progress with strategy use. Thinking in the language of strategies motivates adolescents because they begin to view success and failures in terms of successfully using controllable strategies rather than innate, unchangeable factors such as ability.

Physiological state implies that failure, or some degree of performance impairment, can result if a person fearing failure is in a hyperactive state. A physiologically hyperactive state includes symptoms experienced during fight and flight responses of the autonomic nervous system, such as increases in heart rate, breathing rate, and sweating. Emotional state refers to the mood one is in when performing a task, such as feeling anxious.

Efficacy beliefs vary between pupils and will actually fluctuate within an individual for different tasks. In many activities, self efficacy contributes to self-esteem. Self efficacy beliefs affect how pupils approach new challenges and will contribute to performance since these beliefs influence thought processes, motivation, and behaviour. Self efficacy is not static and can change over time resulting from periodic reassessments of how adequate one's performance has been.
2.2 Literature on Positive Beliefs

It is not just perceptions, attitudes and feelings alone that affect mathematics performance but positive mathematical beliefs (thus I can and I cannot beliefs) that can lead to increased mathematical achievement. However, it should be noted that, the relationship between affective factors is not simple, linear and unidirectional; rather it is complex and convoluted. Gresalfi and Cobb (2006) cited by Grootenboer and Hemmings (2007) suggested that learning in mathematics is more than just the acquisition of skills and knowledge and it is not sufficient to focus exclusively on the ideas and skills that we want to learn.

But the establishment of mathematical self efficacy in pupils is also important. The significance of mathematical beliefs was highlighted by Wilkins and Ma (2003:52) who said that,

A person's mathematical disposition related to her or his beliefs about and attitude toward mathematics may be as important as content knowledge for making informed decisions in terms of willingness to use this knowledge in everyday life.

The Roman poet Virgil cited by Pajares (2002) wrote that "they are able who think they are able." French novelist Alexander Dumas wrote that, when people doubt themselves, they make their own failure certain by being the first to be convinced of it. There is now ample research evidence to suggest that Virgil and Dumas were absolutely correct. Good preparation accompanied by confidence maximizes success. Pupils, who approach their academic work with confidence and sound self-regulatory practices, work harder, and are more likely to
surmount obstacles, prove more resilient after setbacks, and engage in tasks with greater serenity and lower anxiety.

Self-beliefs strategies ultimately become habits of thought and action that are developed like any habit of conduct. There is evidence to support William James's (1896/1958) contention that the self-regulatory processes individuals use to make most of their decisions become automatic and are exercised primarily unconsciously. Many psychologists contend that individuals perform the bulk of their actions on autopilot, as it were, making use of "automatic self-regulation" (Bargh & Chartrand, 1999) cited by Pajares, (2002). What this means, of course, is that people are, in later life, slaves to the self-belief practices they mastered in earlier years. These habitual ways of behaving exert a powerful influence on the choices people make and on the success or failure they experience.

Regarding self-beliefs, researchers have long known that the earlier a belief is incorporated into a belief system, the more difficult it is to alter (James, 1896/1958). Newly acquired beliefs are most vulnerable to change. In fact, people tend to hold on to beliefs based on incorrect or incomplete knowledge, even after correct explanations are presented to them. Those that are developed early persevere and self-perpetuate. For these reasons, educators face the critical challenge of making their students' positive self-beliefs and self-regulatory strategies automatic and habitual as early as possible. Teachers are influential in helping pupils develop the self-belief and self-regulatory habits that will serve them throughout their lives.
2.3 Literature on Higher Achievers versus Lower Achievers

Cheng and Westwood (2009) in a study of 150 children attending a government school in Hong Kong found that, when the self-efficacy ratings for lower achievers were compared, 10 significant differences were detected (p< .05) all showing that higher achieving children held more positive beliefs about their self efficacy in relationship to personal reliability, self management in school work and leaning particular subjects such as mathematics. From their research 75% of the higher achievers rated themselves higher in self efficacy. This research revealed clearly that lower achievers were less certain than higher achievers about their ability to learn.

2.4 Literature on Self Efficacy and Mathematics Performance

The relationship between and among beliefs, attitudes and feelings towards mathematics, and achievement in mathematics has been the focus of a number of studies in general, these studies report that there is a correlation between affective views of mathematics and mathematical achievement (For example, Antonnen, 1969; Fennema and Sherman, 1978; and Bouchey and Harter, 2005).

Self efficacy links to both general academic achievement and maths achievement. In a meta-analysis for example, positive and statistically significant relationships were found between self efficacy, academic performance, and persistence for a number of disciplines (Multon, Brown, & Lent, 1991). Self efficacy also positively related to achievement in community
college students (Silver, Smith, & Greene, 2001) op cit. Self efficacy in mathematics may affect mathematics learning, choice of maths related courses, amount of effort exerted, and persistence in mathematics.

West-wood and Cheng (2009) observed a significant positive association between self efficacy and achievement ($r=0.31$) suggesting that in the sample they studied, there was a slight to moderate tendency for children with higher self efficacy to obtain higher academic test results, and vice versa. However, they noted that a correlation coefficient of 0.31 should not be interpreted as reflecting a very powerful association between the two variables.

Self-efficacy beliefs also contribute to performance since they influence thought processes, motivation, emotions and behaviour (Bandura, 1997). The first effect is on pupils' thoughts. It is common to hear children who are performing poorly in mathematics to make self doubting comments such as 'I am not clever enough' or predict that 'I will never get the right answer'. This is often followed by an abandonment of tasks, as their efforts are perceived as futile. For students who view ability as alterable, poor performance is a stimulant for activating behaviour and thoughts that become self fulfilling in the sense that they raise performance. However, low achieving children may conceive of their cognitive ability as innate or stable and regard themselves as lacking capabilities (Cain & Dweck 1995, Stipek & Gralinsski 1996). Negative experiences from failure can generate that which blind students' ability to evaluate other options to shape
situations towards success (Mantzicopoulos 1997). These pupils may withdraw from enhancing activities, do not promote themselves because it could attract attention to their perceived lack of intellectual ability, negatively compare themselves with others, and debase the worth of their achievement.

A second effect of self efficacy is on pupil motivation. A substantial level of motivation is cognitively generated Bandura (1997) and pupils beliefs are highly relevant to mathematics achievement. Low achievers in mathematics classes may have little reason to enjoy their class-time, being unable to conceive of the purposes of tasks, or unable to complete tasks that serve to reinforce the lack of relevance of much of mathematics to their lives. In other words, higher achievers see mathematics as necessary to their lives while low achievers do not and are less convinced as to why mathematics is necessary and can be much less motivated.

The third path of influence of efficacy on performance is through pupils' emotions. A sense of efficacy to deal with anxiety and stress can influence how pupils feel and behave in class. Pupils' help seeking behaviours in mathematics are influenced by their sense of autonomy and competence and by a class of atmosphere of collaboration and social supportiveness (Greenberg 1998). How pupils think and feel precipitates their involvement and classroom mood is influential on those feelings. Being in a positive mood has shown to raise both

The fourth factor influenced by self efficacy is pupils' behaviour. In particular, pupil willingness to engage with tasks, take part in discussions, and use appropriate behaviour is influenced by perceptions of self efficacy for these acts. Individuals high in self-efficacy attempt challenging tasks more often, persist longer at them, and exert more effort. If failure results, highly efficacious individuals attribute it to a lack of effort. When they succeed, they credit their achievement to their abilities. The perception that their abilities caused the achievement affects the outcome rather than their actual abilities. (Bandura, 1986: 395) cited by Fours (2009) who goes on to say that, those who regard themselves as inefficacious shy away from difficult tasks, slacken their efforts and give up readily in the face of difficulties, dwell on their personal deficiencies, lower their aspirations, and suffer much anxiety and stress. Such self-misgivings undermine performance.

Conversely, individuals with high self-efficacy frequently persevere despite difficult tasks or challenging odds and often succeed because perseverance usually results in a successful outcome.

Fluctuations in performance may be explained by fluctuations in self-efficacy. For example, varying beliefs in self-efficacy may alter task outcome, whether it
involves two similarly-skilled individuals or the same person in two different situations (Bandura, 1997).

2.5 Conclusion of Literature Review

This literature has highlighted how self-efficacy beliefs are developed, and how they influence academic performance. It is noted also, that there is a positive relationship between mathematical self efficacy and performance. Pupils with low self efficacy perform poorly while those with high mathematical self efficacy perform well. Pupils not performing well can be assisted by improving their self efficacy for mathematics. Raising mathematical self efficacy can transform a reclusive, self doubting, wayward and at risk pupils through the encouragement of self-regulation, fostering the acquisition of new skills, and applying prior knowledge and skills first to familiar contexts and then generalizing to new problems. However, this review has shown an information gap as far as the relationship between pupil mathematical self efficacy and high school mathematics performance is concerned in Zambia. Based on the literature reviewed, there are few reports on some aspects of the affective domain but nothing on the relationship between mathematical self efficacy and pupil performance at high school. Hence, there is need to investigate if pupils hold positive beliefs and the relationship between their mathematical self efficacy and their mathematical performance.
CHAPTER THREE
METHODOLOGY

3.0 Introduction

This chapter discusses the methodology that was used to carry out the research. It also discusses the validity and reliability of the instruments used.

3.1 Research Design

Both qualitative and quantitative methods were used. There are two ways through which science views the nature of knowledge known as the positivist and interpretive paradigms. Positivists or quantitative researchers "assume that features of the human environment have an objective reality, meaning that they exist independently of the individuals who created them or are observing them" (Broodryk, 2005:121). To them, the world and human behaviour have to be studied through scientific means similar to the physical sciences. And mathematics is one of the physical sciences therefore; it can be studied using quantitative methods. But this mathematics is not taught in a vacuum but to a pupil who is a human being who has his own belief system. One of these beliefs is self efficacy hence, the combination of both quantitative and qualitative designs. Positivists argue that in the same way matter is measured and quantified in the physical sciences so should human behaviour be studied and understood. Furthermore, quantitative researchers use the study of samples and populations
and depend heavily on numerical data and statistical analysis to objectively understand the world of their study.

Additionally, the interpretive or qualitative researchers view the world that "aspects of the human environment are constructed by the individuals who participate in the environment and social reality exist only according to the meanings that individuals give them" (ibid).

My interest was to find out if there was a significant association between mathematics performance and self efficacy. Therefore, in order to relate the two, there was need to triangulate otherwise the findings could have been superficial. Triangulation is the use of more than one method in order to understand the same reality.

No single method ever adequately solves the problem of rival causal factors. Because each method reveals different aspects of empirical reality, multiple methods of observation must be employed. This is termed triangulation now offer as a final methodological rule the principle that multiple methods should be used in every investigation (Denzn, 1978b:28) cited in Chileshe (2009)

Having in mind that the purpose was to find the relationship between the two concepts, I saw the need of confirming some of the ideas, views and perspectives from the informants by using both qualitative and quantitative designs.

3.2 Research procedure

Research question number one was answered quantitatively by the use of a frequency table and general tables. Research question number two was answered
by the use of a t-test and number three by the use of Pearson correlation coefficient. Because of the nature of the research topic the same research questions were analysed qualitatively by the use of themes.

3.3. Data Collection Procedure

Permission was sought from the principal standards officer and the head teachers of the three high schools to carry out this research.

Information was acquired from Primary sources. Primary information was gathered by means of empirical study. Respondents were required to complete a questionnaire. There was one pupil’s mathematics questionnaire which comprised a three-point likert-scale type, an interview guide for teachers, a pupils’ focused group discussion and a test on number and numeration, indices, variation, sets and the basic process of algebra. The test was based on the syllabus. A focus group discussion was done in order to establish whether pupils understood what it meant to be mathematically self efficant. The questionnaire had twenty-three statements. The questions on the questionnaire were formulated in line with Cheng (2009) but modified by the researcher to suit the Zambian situation.

Selected pupils were given the questionnaires in the usual classrooms. Instructions were given by the researcher to the learners. The learners were told to ask wherever they were not clear. After filling in the questionnaire, a test was
given. Before attempting the question, learners were asked the following question: “Are you able to get the questions given to you correctly?” All the learners responded that they could. A test was administered and no one responded that they had all the questions correct.

The teachers and the pupils were assured that the information obtained would be treated confidentially and that results would be used for academic purposes only. This is a reason why in the data presentation section only pseudonyms are used.

Prior to this study, a pilot was done at one boys’ high school and a mixed high school to test for the readability of the research instruments. It was discovered that some questions were not constructed properly. These questions were rephrased with some examples added in some cases. The likert scale was also amended from a five-point to a three-point because it was established that pupils could not understand statements like “typically a characteristic of me” but “yes, no and I don’t know”.

3.4 Study Population

The study population was grade 11 pupils at the three high schools aged between 14 to 19 years, teachers of mathematics heads of mathematics department, school managers and standards officers (mathematics). For this age range, pupils are likely to have formed positive beliefs and the teachers are
expected to have a wider knowledge of their pupils. Secondly, most senior mathematics teaching and learning is completed by the end of Grade 11.

3.5 Sample Size and Sampling Procedure

Three grade 11 classes were picked which had twenty-eighty, twenty-seven and twenty-six pupils respectively. Eighty-one pupils were involved in this research (twenty-six girls and fifty-five boys), three teachers of mathematics and one standards officer (mathematics). There were more boys than girls in the two government school classes sampled. The situation was different from the private school class. The class from the private school had more girls than boys. The two classes from the government school were taking pure sciences while the class from the private school was a non pure science class.

The sample was purposively sampled to promote equity in the class because during the pilot study it was established that some pupils complained of not taking part in the study. Additionally, the method enabled the researcher to get people whom she thought had information, competence, experience and clout to answer the set out questions. Cohen and Manion,(1994:89) point out that

In purposive sampling, researchers handpick the cases to be included in the sample on the basis of their judgement of their typicality. In this way, they build up a sample that is satisfactory to their specific needs.

It is in this quality of purposive sampling that the researcher found to be important in selecting informants by quality of the information they possessed and not by the number of informants.
3.6 **Research Instruments**

There were five instruments used namely, pupils self efficacy questionnaire, a test, focus group discussion guide, interview schedule for teachers and past performance mark sheet. The pupils self efficacy questionnaire, focus group discussion guide and interview schedule for teachers were used to answer research question number one; which sought to investigate if pupils at high school hold positive beliefs concerning their own self efficacy in mathematics. The past performance mark sheet, interview guide for teachers, test and pupils self efficacy questionnaire were used to answer research question number two which sought to find out if there is a difference between higher and low achievers in terms of mathematics self efficacy. All the five instruments were used to answer research question number three which sought to investigate if there is a significant association between pupils level of mathematics self efficacy and their performance in mathematics.

3.7 **Description and justification of research instruments**

3.7.1 **Interview schedule**

One way of learning about things we cannot directly observe is by asking people who have or are experiencing such situations to tell us. By asking people to tell us what they are experiencing, we as listeners begin to understand and see the world of the other person in a deeper way. In research, this process of understanding another person's world view can be achieved by the use of interviews. Interviews were used by the researcher to collect descriptive
information in order to get an in depth meaning and understanding of the world view of the informants

To collect data from this instrument I was writing down all the important notes into categories that corresponded with specific research questions. Questions to guide the interview were constructed by the researcher.

3.7.2 Test and records

The records referred to are the mark sheets. This document was very important in this research as it provided information on the sex and ability of the pupils. The mark sheet confirmed some of information obtained through interviews such as performance of higher and lower achievers. It also helped to find the relationship between performance and self efficacy.

The test was based on the five topics that appeared on the three sheets of paper that were submitted by the subject teachers. It facilitated in the generation of the correlation and consequently verifying that there is a relationship between self efficacy and mathematics performance.

Two visits were made to the three schools. The first one was to make an appointment, meet the subject teachers and correct the list of topics that the pupils had already covered. The second one was for the administration of the test, questionnaire focus group discussion and the interview guide for pupils.
3.7.3 Self efficacy questionnaire

My interest was to find out if pupils hold positive beliefs concerning their own mathematics self efficacy, if there was a difference between higher and low achievers in terms of their mathematics self efficacy and if there was a significant association between self efficacy and mathematics performance. Hence, the use of a questionnaire.

How people feel, or what they believe is their attitude. But it is difficult, if not impossible, to describe and measure attitude. But through the use of questions and by getting pupils expressed reaction to statements, a sample of their opinion was obtained. From this statement of opinion, I was able to infer or estimate their attitude—what they really believe. This was arrived at bearing in mind the limitations that have been put across by Khan and Best. (2008:329) as follows:

Inferring attitude from expressed opinion has many limitations. People may conceal their attitudes and express socially acceptable opinions. They may not really know how they feel about a social issue, never having given the idea serious considerations. People may be unaware of their attitude about a situation in abstract. Until confronted with a real situation, they may be unable to accurately predict their reaction or behaviour.

Even behaviour itself is not always a true indication of attitude. Even though there is no sure method of describing and measuring attitude, the description and measurement of opinion may, in many instances, be closely related to people's real feelings or attitudes.

With these limitations in my mind, I asked pupils directly on how they felt about when they were about to write a test or an examination. This technique employed a schedule or a questionnaire of a closed form. I also employed the interview process in which informants expressed their opinions orally.
Additionally, I ensured that I inferred their attitudes from reactions to projective devices through which they reveal attitudes unconsciously. A projective device is a data-gathering instrument that conceals its purpose so that the subjects cannot guess how they should respond to appear in their best light. Thus their real characteristics are revealed. (ibid, 330). My questionnaire did not specify that I was assessing pupils self-efficacy but it read that the items were on an appraisal inventory (see appendix A).

3.8 Description and justification of data analysis instruments and Procedure

The data collected were analysed based on the concept of self-efficacy. The concept proposes that, pupils obtain information to appraise their self-efficacy from their past performance, vicarious experience, persuasion they receive from others and their physiological and emotional reactions. Self-efficacy has influence on choice of tasks, effort, persistence, resilience and achievement. The concept further proposes that those who regard themselves as inefficacious shy away from difficult tasks, slacken their efforts and give up readily in the face of difficulties, dwell on their personal deficiencies, lower their aspirations, and suffer much anxiety and stress. Such self-misgivings undermine performance.

Conversely, individuals with high self-efficacy frequently persevere despite difficult tasks or challenging odds and often succeed because perseverance usually results in a successful outcome. The concept entails that, success in mathematics depends on belief that one is capable of constructing mathematical
formulae, understanding mathematics, acquiring mathematics understanding and solving of mathematical problems. As well as viewing mathematics as an expanding field of human invention which is dynamic and problem- driven, structured, unchanging body of knowledge. Lastly, viewing mathematics as a collection of procedures, facts and skills.

The first objective was to investigate if pupils at high school hold positive beliefs concerning their own self efficacy. To establish the number of pupils who held positive beliefs, a frequency general table and tables were constructed while the emerging themes were used to analyse responses from the teachers’ interview schedule and pupil focus group discussion.

Themes were put into groups that corresponded with specific questions on the teachers’ interview schedule and the pupils’ focus group discussion. The major challenge was to find answers and trustworthy answers to the questions. This was done by re-reading the original scripts of the interviews and selecting relevant comments while removing perceived repetitions. The final product was then presented in prose form by paying particular attention to experiences, observations and feelings of respondents.

A likert type scale was constructed in line with (Best and Khann 2008: 330). I first collected a number of statements on self efficacy from the study that was presented by Cheng and Westwood (2009) in China. According to Best and
Khann(2008), the correctness of the statements is not important as long as they express opinions held by a substantial number of people. It is important that they express definite favourableness and unfavourableness to a particular point of view and that the number of favourable and unfavourable statements is approximately equal. (Ibid, 330b)

After the statements were gathered a test was administered at Munali boys’ high School and Lusaka High school (GRZ) in Lusaka district and only those items that correlated with the total test were retained. This test for internal consistency helped me to eliminate statements that were ambiguous or that were not of the same type as the rest of the scale. This was done in line with (Ibid.330c) who says that,

After the statements have been gathered, a trial test should be administered to a number of subjects. Only those items that correlate with the total test should be retained. This testing for internal consistency will help to eliminate statements that are ambiguous or that are not of the same type as the rest of the scale

According to (ibid, 330d) the attitudes or opinion scale maybe analysed in several ways.

The simplest way to describe opinion is to indicate percentage responses for each individual statement. For this type of analysis by item, three responses-‘‘agree’’, ‘‘undecided’’, and ‘‘disagree’’ - are preferable to the usual five.

I did exactly the same and coded the responses from my informants as discussed below.

The coding used was 1=Yes, 2=No. and 3=I do not know.
Responses from pupils' mathematics self efficacy were calculated. High "yes" scores on the questionnaire reflected high mathematical self efficacy while low "yes" scores reflected low mathematical self efficacy towards solving problems involving number and numeration, indices, variation, sets and the basic process of algebra. Frequencies and percentages were used to interpret data. The following are the interpretations for the "yes" score from the pupils self efficacy questionnaire:

- A frequency of 0-8 out of twenty-three responses and a percentage of 0-35 "yes" score were interpreted as having a low mathematical self efficacy.
- A frequency of 9-16 out of twenty-three responses and a percentage of 39-70 "yes" score were interpreted as having an average mathematical self efficacy.
- A frequency of 17 out of twenty-three responses and above as well as a percentage of 74 was interpreted as having a high mathematical self efficacy.

Furthermore, frequencies of the self efficacy items pupils were doing were counted and presented in the form of tables (see chapter 4; tables 2 and 3).

The second question which sought to find out if there is a difference between higher and low achievers in terms of mathematics self efficacy was analysed using a t-test. A t-test is a useful technique for comparing mean values of two
sets of numbers. The comparison provided the researcher with a statistic for evaluating whether the difference between two means was statistically significant. Additionally, to find out if there was a difference between higher and lower achievers in terms of mathematics self efficacy, the Examination Council of Zambia (ECZ) standard ratings were used. According to the examination council of Zambia’s (ECZ’s) standard ratings, 70% and above is a distinction while 34% and below is unsatisfactory. A candidate getting 70% and above is considered as a higher achiever while one getting 34% and below is taken as a low achiever. Using the ECZ criteria, twenty-six higher achievers and fifteen lower achievers were sampled. These were the numbers of higher and lower achievers from 81 pupils, the rest were average achievers. Thereafter, a t-test was run and responses from the teachers’ interview guide were analysed thematically, while the mark sheet was used to establish the ability of the pupils. On the other hand, the questionnaire was used to find the mean, standard deviation standard error of the mean, t-value, significance at two tailed, mean difference and the lower and upper bound at 95% confidence interval of the difference.

The last research question which sought to investigate if there is a significant association between pupils level of mathematics self efficacy and their performance in mathematics was analysed using a Pearson correlation coefficient and themes. I opted to use a correlation because a correlation is one of the most common forms of data analysis. It can provide an analysis that
stands on its own, and also because it underlies many other analyses, and can be a good way to support conclusions after primary analyses have been completed. There are three types of correlation namely, bivariate, partial and distances. My interest was in a bivariate correlation because it is the one that can be used for situations where the researcher is only interested in relationship between two variables. The pupils’ past and present performance were correlated to the pupils’ self efficacy questionnaire ‘yes’ responses. While responses from the focus group discussion and the interview guide for teachers were analysed thematically. The method of analysing using themes is the same as the one used under research objective number one.

A Qualitative Focus Group Content Analysis (QFGCA) technique was also used in this study. A focus group content analysis has its emphasis on meaning rather than on quantification. This process involves studying the transcript or notes taken carefully by the researcher, sorting the discussion into category of thought and inquiry. They are organised around the research questions of the study.

3.9 Validity

Content validation of the mathematics self efficacy questionnaire was established by cross referencing the content of the questionnaire to those reported in literature as well as cross referencing the pupils’ responses to the teachers’ response. The test items on the pupils’ test were copied from syllabus
D text book by Talbert. This is one of the recommended books for teaching high school mathematics.

3.10 Reliability

The reliability of the mathematics self efficacy questionnaire was based on the responses from the two sets of pupils, 15 boys from a boys' high school and 15 pupils (12 boys and 3 girls) from a mixed sex high school. The difference in the responses was minimal.

3.11 Limitations of the Study

The current grade 12 analysis of results were not looked at due to limited time and a lot of bureaucracy in accessing these results. Had this been done, it would have provided a good picture of the current performance. Future research should look into this.

The sample size was too small; hence, the findings might not be generalized. Future research should look at increasing the sample size.

The high positive belief was in line with what Westwood and Cheng (2009) found among primary school pupils in Hong Kong. However, the current responses might be said to be unrealistic because the sample was purposively and conveniently sampled by the teachers. It is possible that only those who were known to be good performers in mathematics by them were picked. These
responses should also be treated with caution because it is common practice in our tradition to be good to the visitors as a sign of politeness. Therefore, maybe pupils and their teacher were just responding like that to impress the researcher.

A likert-type scale is somewhat inexact and fails to measure opinion with the precision one would desire. There is no basis for belief that the three positions indicated on the scale are equally spaced. The interval between "yes" and "no" may not be equal to the interval between "no" and "I do not know". It is unlikely that the respondent can validly react to a short statement on a printed form in the absence of real life qualifying situations. It is doubtful whether equal scores obtained by several individuals indicate equal favourableness towards the given position: Actually, different combinations of position can yield equal score values without necessarily indicating equivalent positions of attitude or opinion. Although the opinionnaire provides for anonymous response, there is a possibility that people may answer according to what they think they should feel rather than how they feel. (Best & Khann 2008).
CHAPTER FOUR
FINDINGS OF THE STUDY

4.0 Introduction
This chapter presents the findings of the study in line with the objectives.

4.1 Positive mathematical self efficacy beliefs
- The first objective was to investigate if pupils at 'A', 'L' and 'T' high schools hold positive mathematical self efficacy beliefs. The likert scale was used. The coding used was 1=Yes, 2=No, 3=I do not know. A frequency of 0-8 out of twenty-three responses and a percentage of 0-35 yes score were interpreted as having a low mathematical self efficacy.
- A frequency of 9-16 out of twenty-three responses and a percentage of 39-70 yes score were interpreted as having an average mathematical self efficacy.
- A frequency of 17 out of twenty-three responses and above as well as a percentage of 74 was interpreted as having a high mathematical self efficacy.

Responses from pupils' mathematics self efficacy were calculated. High 'yes' scores on the questionnaire reflected high positive mathematical self efficacy while low yes positive scores reflected low mathematical self efficacy towards solving problems involving number and numeration, indices, variation, sets and the basic process of algebra. Frequencies and percentages were calculated on the 'yes' response as shown in Table 1 while the 'no' and the 'I do not know' where neglected because they were very few pupils who said 'no' and 'I do not know.'
Table 1 below shows the level of their positive mathematical self efficacy beliefs, least and highest mathematical self efficacy beliefs of pupils respectively.

Table 1: Level of pupils positive mathematical self efficacy beliefs

<table>
<thead>
<tr>
<th>Name of school</th>
<th>High</th>
<th>Medium</th>
<th>Low</th>
</tr>
</thead>
<tbody>
<tr>
<td>'A'</td>
<td>16 (20.0%)</td>
<td>8 (10.0%)</td>
<td>4(5.0%)</td>
</tr>
<tr>
<td>'L'</td>
<td>13 (16.0%)</td>
<td>14 (17.0%)</td>
<td>-</td>
</tr>
<tr>
<td>'T'</td>
<td>6 (7.0%)</td>
<td>20 (25.0%)</td>
<td>-</td>
</tr>
<tr>
<td>Total</td>
<td>35 (43.0%)</td>
<td>42 (52.0%)</td>
<td>4(5.0%)</td>
</tr>
</tbody>
</table>

From the table, it can be seen that out of eighty-one pupils thirty-five had a high level, forty-two had a medium level and four had low level of self efficacy. School ‘A’ had the highest number of pupils with a high positive mathematical self efficacy, followed by schools ‘L’ and ‘T’. School ‘T’ had the highest number of pupils with a medium level of positive mathematical self efficacy and very few pupils with a high positive mathematical self efficacy. School ‘A’ had four pupils with pupils with a low level of positive mathematical self efficacy while schools ‘T’ and ‘L’ had none.

Additionally, self efficacy beliefs that most pupils indicated to have been not been following and those most of them were following were also counted and presented as shown in tables 2 and 3.

Mathematics self efficacy beliefs of pupils

Table 2 shows the least popular self efficacy belief. In all the three schools, pupils reported that they were unable to work in groups and were also not able to discuss mathematical problems with new classmate. In school ‘T’ pupils had the least efficacy in learning a new card game or board game (e.g. chess, draft) while in school ‘A’ they had the least efficacy in resisting pressure from friends.
to do things that could make them not to finish their homework; solving disconnected problems with a certain time; building new skills on learned material; and keeping up or remembering all the steps learnt. In school ‘L’ pupils had least self efficacy in remembering how to do mathematical problems and working quickly and accurately in sets of problem.

Table 2: Least mathematics self efficacy beliefs of pupils

<table>
<thead>
<tr>
<th>Name of school</th>
<th>Items</th>
</tr>
</thead>
<tbody>
<tr>
<td>'A'</td>
<td>Discussing mathematical problems with new classmate, unable to work in groups</td>
</tr>
<tr>
<td></td>
<td>Resisting pressure from friends to do things that could make them not to finish their homework</td>
</tr>
<tr>
<td></td>
<td>Solving disconnected problem with a certain time</td>
</tr>
<tr>
<td></td>
<td>Building new skills on learned material</td>
</tr>
<tr>
<td></td>
<td>Keepin g up or remembering all the steps learnt</td>
</tr>
<tr>
<td>'L'</td>
<td>Discuss mathematical problems with new classmate, unable to work in groups</td>
</tr>
<tr>
<td></td>
<td>Remembering how to do mathematical problems</td>
</tr>
<tr>
<td></td>
<td>Working quickly and accurately in sets of problem</td>
</tr>
<tr>
<td>'T'</td>
<td>Discussing mathematical problems with new classmate, unable to work in groups</td>
</tr>
<tr>
<td></td>
<td>Learning a new card game or board game (e.g. chess, draft)</td>
</tr>
<tr>
<td></td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>-</td>
</tr>
</tbody>
</table>

No pupil worked in groups and discussed mathematical problems with a new classmate.

Table 3 also shows the most popular self efficacy. In all the three schools, pupils reported that they were completing exercises and practicing what they had learnt. In school ‘T’ pupils had the highest efficacy in producing work that
meets teacher’s expectations and participating in lessons and class activities while in school ‘A’ they had the highest efficacy in coping with an environment where they study the same material. In school ‘L’ pupils had highest self efficacy in remembering rules and participating in lessons and class activities.

Table 3: Highest mathematics self efficacy belief of pupils

<table>
<thead>
<tr>
<th>Name of school</th>
<th>Items</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Completing exercises</td>
</tr>
<tr>
<td>‘A’</td>
<td>Practicing what they have learnt</td>
</tr>
<tr>
<td></td>
<td>Coping with an environment where they study the same material</td>
</tr>
<tr>
<td>‘L’</td>
<td>Completing exercises</td>
</tr>
<tr>
<td></td>
<td>Practicing what they have learnt</td>
</tr>
<tr>
<td></td>
<td>Remembering rules</td>
</tr>
<tr>
<td></td>
<td>Participating in lessons and class activities</td>
</tr>
<tr>
<td>‘J’</td>
<td>Completing exercises</td>
</tr>
<tr>
<td></td>
<td>Practicing what they have learnt</td>
</tr>
<tr>
<td></td>
<td>Producing work that meets teacher’s expectations</td>
</tr>
<tr>
<td></td>
<td>Participating in lessons and class activities</td>
</tr>
</tbody>
</table>

All pupils were completing the exercises and practicing what they had learnt. Furthermore, responses from the informants were analysed thematically as shown in point 4.1.

4.1 Definition of Positive Belief

Pupils were also able to define what they meant by positive belief. They defined it as an inner inspiration that they can do something and have positive effects on performance. The same pupils went on to say that actually faith pushes one to work hard as it gives one the strength and encouragement to do something.
4.2  Higher Achievers versus Lower Achievers

The second objective was to find out if there was a difference between higher and lower achievers in terms of mathematical self efficacy. A one sample t-test was run and the results are in Table 4. Themes are shown in the last paragraph.

Table 4: Differences In Terms Of Perceived Mathematics Self Efficacy between Higher and Lower Achievers

<table>
<thead>
<tr>
<th>Achievement level</th>
<th>Test value = 0</th>
<th>Mean difference</th>
<th>95% confidence interval of the difference</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>t</td>
<td>df</td>
<td>Sig. (2-tailed)</td>
</tr>
<tr>
<td>Higher achiever self-efficacy</td>
<td>33.50</td>
<td>25</td>
<td>.00</td>
</tr>
<tr>
<td>Lower achiever self-efficacy</td>
<td>11.87</td>
<td>14</td>
<td>.00</td>
</tr>
</tbody>
</table>

One-Sample Test

<table>
<thead>
<tr>
<th></th>
<th>Test Value = 0</th>
<th>95% Confidence Interval of the Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>t</td>
<td>df</td>
</tr>
<tr>
<td>higher achiever self efficacy</td>
<td>33.503</td>
<td>25</td>
</tr>
</tbody>
</table>

Every unique value of the t-statistic and its associated degrees of freedom has a significance value. The t-value for higher and lower achievers has the value of 33.50 and 11.87 respectively and degrees of freedom have value of 25 and 14 with an associated significance level of 0.00. The significance level tells us that the probability that there is no difference between higher and lower achievers is
very small. To be specific, less than one time in a thousand would obtain a mean difference of 16.92 and 12.07 or larger between these groups if there were really no difference in terms of mathematics self efficacy. In other words, the difference in perceived mathematical self efficacy between higher achievers and lower achievers is therefore significant. There is a difference between higher and lower achievers in terms of mathematical self efficacy.

The three teachers and the standards officer (mathematics) also said that there was a difference between the two sets of pupils. The higher achievers had a higher self efficacy than the lower achievers.

4.3 Relationship between Mathematics Self Efficacy and Performance in Selected Topics

The last objective aimed at finding out if there was any significant association existing between grade elevens level of self efficacy and their performance in the test in the five selected topics. These topics are in the Zambian school syllabus and were common on the three pieces of paper that were submitted by the subject teachers on the topics that were covered by the pupils. To answer this objective a bivariate correlation was run using SPSS. Results were as shown in Tables 5 and 6. Responses from informants were presented thematically as in point 4.4, 4.5, 4.5.1, 4.5.2 and 4.5.3.
Table 5: Nonparametric Correlations for past performance versus Mathematics self efficacy (Spearman’s rho)

<table>
<thead>
<tr>
<th>Current self efficacy</th>
<th>Correlation coefficient</th>
<th>Sig. (2-tailed)</th>
<th>N</th>
<th>Past performance</th>
<th>Correlation coefficient</th>
<th>Sig. (2-tailed)</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current self efficacy</td>
<td>1.00</td>
<td>.</td>
<td>81</td>
<td>0.46**</td>
<td>1.00</td>
<td>.</td>
<td>81</td>
</tr>
<tr>
<td>Past performance</td>
<td>0.46**</td>
<td>0.00</td>
<td>81</td>
<td>1.00</td>
<td></td>
<td>.</td>
<td>81</td>
</tr>
</tbody>
</table>

** Correlation is significant at the 0.01 level (2-tailed)

Table 6: Nonparametric Correlations for present performance versus Mathematics self efficacy (Spearman’s rho)

<table>
<thead>
<tr>
<th>Mathematics self efficacy</th>
<th>Correlation coefficient</th>
<th>Mathematics self efficacy</th>
<th>Present performance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current self efficacy</td>
<td>1.00</td>
<td>0.45</td>
<td></td>
</tr>
<tr>
<td>Sig (2 tailed)</td>
<td>.</td>
<td>0.00</td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>81</td>
<td>81</td>
<td></td>
</tr>
<tr>
<td>Present performance</td>
<td>0.45</td>
<td>1.00</td>
<td></td>
</tr>
<tr>
<td>Sig (2 tailed)</td>
<td>0.00</td>
<td>.</td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>81</td>
<td>81</td>
<td></td>
</tr>
</tbody>
</table>

** Correlation is significant at the 0.01 level (2-tailed)
The correlations on Tables 5 and 6 show positive relationship between pupil's performance in the five topics selected and their mathematical self efficacy in the same. From tables 5 and 6, it can be shown that there was no major difference between the two correlations. In both cases the correlation was positive and was significant at 0.01 (2-tailed). In other words, there is an association between mathematical self efficacy and pupil performance.

4.4 Teachers' Responses on the Relationship between Mathematics Self Efficacy and Pupil Performance

The teachers interviewed said that there was no relationship between mathematics self efficacy and pupil performance. They gave the following reasons:

Few girls get a distinction at grade nine. In addition one teacher said that, performance in mathematics had not been so good for a long time. They were of the view that children are introduced to abstract concepts like 5+3=8 at a tender age instead of concrete mathematical activities like tracing on the ground and physical counting of objects just to mention but a few. Furthermore, they said that, during training teachers are not properly equipped or trained on how to teach some of these concepts. "If one does not understand mathematics, s/he cannot teach effectively". "There is no way a blind man can lead another blind
man. It is acceptable that some pupils are more intelligent than their teachers. But these are rare cases.

They also mentioned that the system is partially to blame. N1 pointed out that between 1980 and 1990, there was a study which was done on the way forward in alleviating poor performance in mathematics but the findings were neither published nor implemented. In that study, it was recommended that pupils should start using more of the ready reckonner than the use of calculator but the opposite was implemented, thus the combined use of a calculator and the computer.

N2 also said that the root cause of pupil underperformance is not with the high schools but with the wrong mathematical approach at basic education level. There is very little the teacher can do at the high school level when the damage has been done at basic education level. Furthermore, the books used have a lot of mistakes especially our Zambian books. The pupils can be self efficant but they might be teaching themselves wrong concepts.

N3 mentioned culture as the main determinant in the inculcation of either positive or negative mathematical self efficacy beliefs. She said that in some Zambian ethnic groups it is taboo for a girl to be seen doing the activities that are performed by boys (for example wire car making, climbing of trees and many others).
Furthermore, she pointed out that, the system is to blame for introducing topics in the syllabus that most teachers are not conversant with. It is very difficult for a teacher who has no background from school or a teaching college to teach effectively. Earth geometry was cited as a challenge to both pupil and teacher mathematical self efficacy.

Other teachers said that, the pupils that are being sent to high schools are not properly taught on how to study maths. The government has really put much emphasis on access. This in turn has compromised quality. When quality is compromised, the end result is a pupil failing to apply what is taught.

In addition other teachers were said to be ill trained. Private schools were cited as an example. It was reported that the results reflected on the term report forms are not a true reflection of what is obtained at the end of high school education. During the term some of the results given to the parents are just impression marks.

N1 mentioned that, before the phasing away of the Junior Secondary section from high school, performance was slightly better. She went on to say that, pupils have access to past examination papers before they are ready for them. Other reasons were that either the pupils are not putting in more, or teachers are failing to deliver or the examinations are not set accordingly.

It was also argued that,
Mathematics requires a lot of practice and most children do not like that. Pupils would like to spend most of their time playing or watching television. Blaming the teacher alone is not a solution. Pupils should be given more home work to practice on and this should be checked by both the teacher and the parents.

Contrary to what the teachers had earlier pointed out, the senior standards officer (mathematics) was of the view that, self efficacy is the belief which is the will to do something and is driven by self confidence, determination and other factors such as a good home and school environment. Therefore, there should be a relationship between the two variables. He went on to say that the relationship is not seen because high school teachers have a negative attitude towards the pupils coming from the basic secondary schools because teachers think pupils are not properly equipped with basic mathematics skills to understand high school mathematics. The teacher is a key factor in boosting/guiding children’s perception, attitude and self efficacy. His concluding words were “lucky is that pupil who can find such a teacher”

Teachers were of the view that there was no relationship while the standards officer said there was a relationship.

4.5 Definition of Mathematics Self Efficacy by Pupils

The pupils at ‘A’ high School responded that, to be mathematically self efficant:

Entails solving mathematics competently, by applying the skills within a specified period of time, with speed and accuracy and by being able to apply different concepts. They also said that it entails understanding and being able to carryout your own mathematical research and being confident in the way one approaches questions.
T School was taken as another case study. The pupils at this school gave only one meaning of being mathematically self efficacy i.e., "ability to solve mathematics problems".

The last school to be studied was L high school. The pupils defined the term mathematical self efficacy as doing well in mathematics. They went on to say "it entails being confident and self motivated and getting three-quarters of the questions correct."

4.5.1 Pupils’ Response on the Relationship between Mathematics Self Efficacy and Performance

Pupils were asked whether there is a relationship between mathematics self efficacy and better performance. At school ‘A’, out of twenty-eight (28; 100%) pupils, twenty-one (21; 75%) pupils said yes, three (3; 11%) pupils said no while four (4; 14%) pupils were not sure.

Those who said yes gave the following reasons:

- Belief constitutes attitude. It is only when one believes in him or herself that s/he can apply the concepts s/he has learnt.
- When one believes in himself or herself, s/he can develop an interest to attempt the problems s/he is faced with.
However, other pupils said “no”, they said that if it were beliefs alone, then everyone would have been passing the examinations. They argued that belief in itself is not a guarantee that you can do better. They further argued that self determination, confidence, academic discipline (e.g., setting a timetable and devotion), and self motivation should accompany ones belief. They further argued that mathematics is not theory and that every one can perform well if it were beliefs alone. They gave an example of an examination and said that every one of them would have been passing examinations if it meant believing in yourself alone than being determined and working towards achieving your objective.

Compared to High School “A”, out of twenty-six (26; 100%), twelve (12; 46%) pupils from T School said that there is a relationship between mathematical self efficacy, while eleven (11; 42%) pupils said “no” and three (3; 12%) pupils did not know.

The pupils who agreed to the statement gave the following reason:

- If you have interest, this will affect your reaction to how you are taught, and that if you have no belief you cannot do better. That is to say if one believes that mathematics is hard, he/she cannot do it. In short, depending on your belief system, it can either affect your mindset positively or negatively.
Those who did not agree gave only one point which was the same as the one which was given by school “A” that is, belief without practice will not show any results.

When pupils at L high school were asked if there was a relationship between mathematical self efficacy and good performance, out of twenty-seven (27; 100%) twenty-four (24; 88%) pupils said “yes”, and there was no (00; 00%) pupil who disagreed and three (3; 11%) were neutral. Those who agreed gave the following reason:

“Live above confession”, which simply means, ‘that what you confess is what you become.’ When you believe in yourself that is when you can develop. It is the belief that boosts the confidence and the courage. It is also the belief that enables one to talk about what can be done and that which cannot be done. The belief pushes one to work hard and do better and vice versa.

There was a difference in the perception of the relationship between mathematical self efficacy and good performance by the pupils. Although, most of the pupils that is, 57 out of 81 (70%) said there was a relationship, others said “no” that is constituting 12 out of 81 (15%) while 10 out of 81 (12%) were not sure.

4.5.2 Sources of Mathematics Self Efficacy

When pupils were asked what drove them into liking maths, they mentioned encouragement from their teachers, parents and peers. All the pupils sampled at “A” high school said they shivered with anxiety when faced with an exam which
really affected their performance. Two boys confessed that this shivering continued until the end of the examinations.

On what had driven them into liking or disliking mathematics, the same sources as the ones given by school “A” pupils came out at school “T” and “L”. Namely, shivering when, namely, encouragement from teachers, parents, and peers. They mentioned also that despite all the encouragement they got, they felt nervous when they were about to write an examination. This is because they were worried about passing and failing. One girl said that “this depends on whether one is good or not in mathematics.” She also said that the only solution to this is to pray for God’s intervention as one is writing an examination.

When asked on how they feel when they are about to write an examination, pupils said that they felt nervous, anxious, panicky and felt like trembling. Others said that “how one feels towards an examination depends on whether one has studied or not.” Those who mentioned this point were the ones who even said they felt calm and happy when they were about to write an examination.

When asked on why they felt that way, the pupils said they were worried of whether the questions would be easy or not and whether they would meet the examiners’ standards of marking their papers. All the pupils were of the view that how they felt really affected their performance.
From these responses, it can be deduced that there is a relationship between self efficacy and mathematics performance.

4.5.3 Ways of improving mathematics self efficacy

Pupils at A high School were further probed to mention some of the things they felt they needed in order to build their mathematics self efficacy and subsequent good performance. They said that, they needed to develop interest in mathematics, practice, and associate with pupils who were performing better, pay attention as well as being interested in the subject. In addition they were of the view that they needed to be determined and ask questions where they were not sure. They needed to be flexible and never hate the teacher. Other views were that they needed to be patient when reading mathematical questions and analyse the questions critically. When studying mathematics, they should be themselves. It is not good copying another person’s strategy unless it fits in their scope of studying. One needs to have a positive mindset when approaching the questions and that bad company should be avoided at all costs.

From this, again, it seems the pupils knew what was expected of them to pass mathematics.

When asked the same question, pupils at T school mentioned practicing everyday as one of the ways of improving their mathematical self efficacy. Others cited the following:
developing interest, cooperating with teachers and fellow pupils, asking where they are not clear, listening to what is being taught, following rules step by step, remembering the formulae and applying it effectively, setting up their own timetable and adhering to it.

On how to improve performance in mathematics, the pupils at “L” school had this to say: needed to practice and apply more time to doing mathematics, should be open to themselves and be humble enough (that is, asking and not pretending as if all is well). They need to concentrate on what they are doing. Furthermore, they need to develop interest and like the subject, pay attention to the teachers as well as friends teaching. They should not hate the subject teacher. They should be helping others because this will be part of their revision. They should associate with people who are good at the subject and be proactive despite the competition and be able to get rid of common mistakes in mathematics. This can be done by taking time and knowing as well as understanding mathematics formulae. Lastly, they should identify their weaknesses and work on their weaknesses.